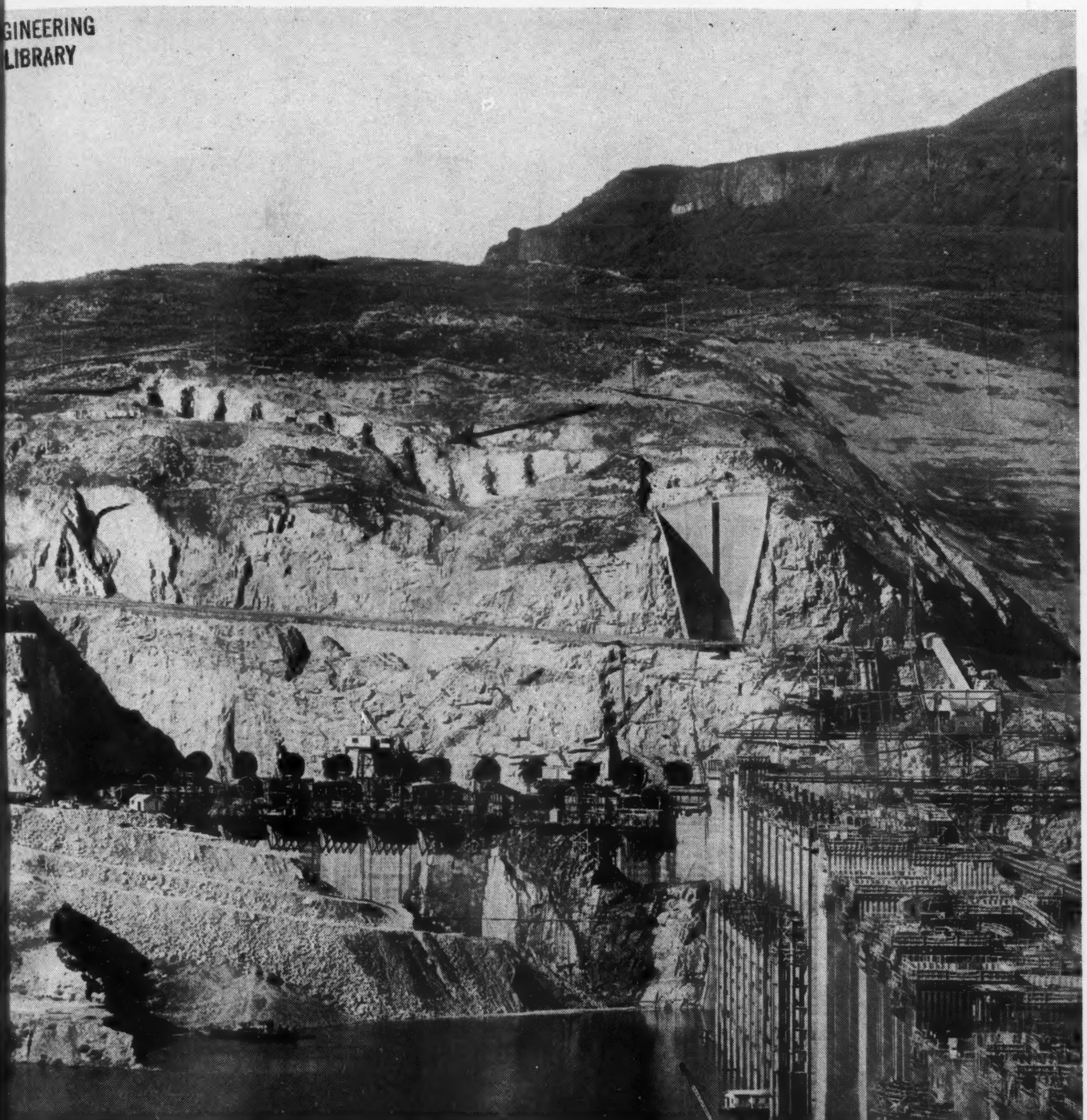
Compressed Air Magazine

FEBRUARY 1946



IRRIGATION BORES AT GRAND COULEE

Water will be pumped over hill to storage reservoir feeding canals.

Bureau of Reclamation Photo

VOLUME 51 • NUMBER 2

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ON THE COVER

RESEMBLING caves chiseled by primitive man, twelve huge tunnels have been driven into one of the granite side walls above Grand Coulee Dam as a part of the works that will irrigate arid lands in south-central Washington. The arrow shows where the tunnels emerge about halfway up the hill. The largest-capacity pumps ever made will force water from the reservoir in the foreground through 12-foot-diameter pipes to be installed in the bores. The pipes will run on over the hill and discharge the water into a canal that will lead to a storage reservoir in Grand Coulee, about 2 miles away. The tunnels vary in length from 487 to 530 feet. They are 23 feet in diameter at the lower ends, tapering to 18½ feet. The space between each pipe and the tunnel walls will be filled with concrete.

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IN THIS ISSUE

PERHAPS surprising to many persons is the fact that Pennsylvania currently ranks as our second-largest mineral-producing state and that it stands first in aggregate production since 1911, when official records were started. Not one of the most important but one of the most interesting Pennsylvania minerals is slate. Our leading article reviews the slate industry's problems and the efforts that are being made to solve them through the scientific approach.

●

SOUTH of the border, in an arid section of Lower California, there was developed during the war without publicity a manganese mine that appears to be rich enough to hold its own in postwar international competition. Its picturesque locale and the methods of mining followed are described by Roger V. Pierce. Page 33.

●

MOUNTAIN VIEW in Oklahoma is one of few American towns that has had two locations. The strange and little-known story of why and how it suddenly changed its site in August, 1903, is related by Carey Holbrook in *It Was Their Move.*

●

MEN would have to have the agility and climbing prowess of squirrels to scurry about a large, modern boiler plant fast enough to adjust its controls so as to maintain efficient combustion. Physical limitations preclude this, but the human brain has devised ingenious systems of automatic control that perform the necessary operations with split-second precision. Beginning on page 42 is described the Hagan combustion-control system which depends upon compressed air for its functioning.

Compressed Air Magazine

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EDITORIAL CONTENTS

ADVERTISING INDEX

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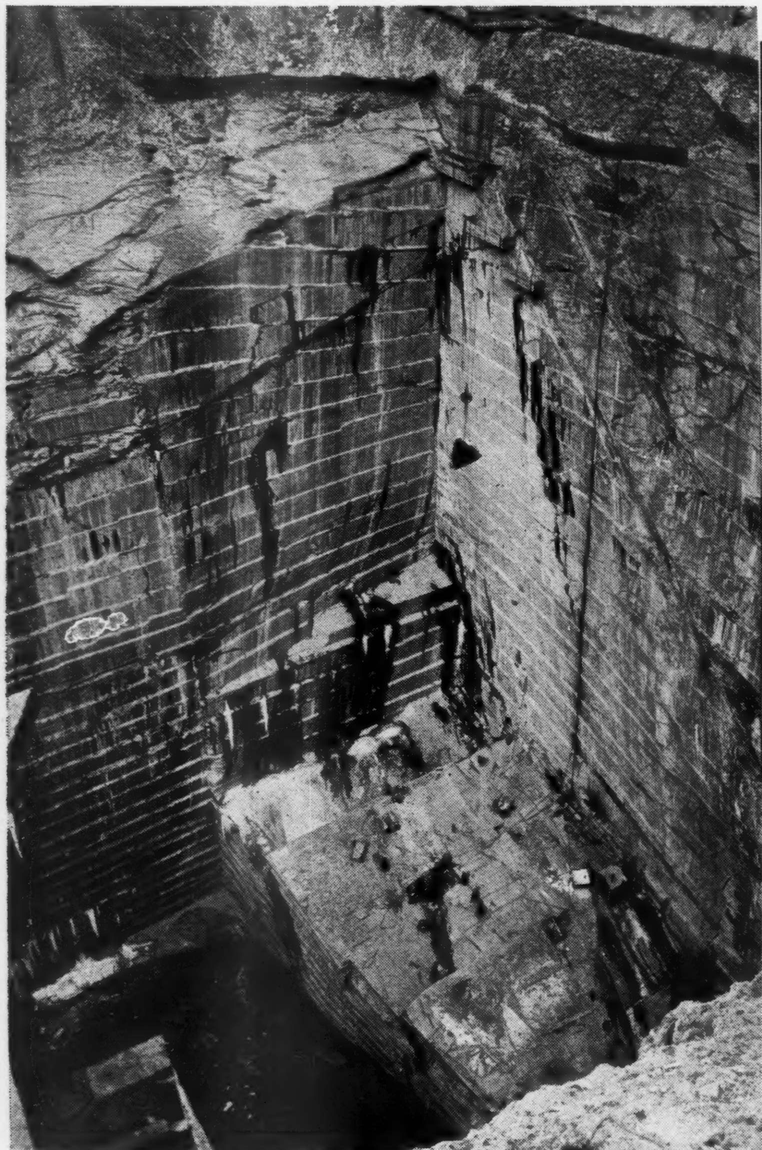
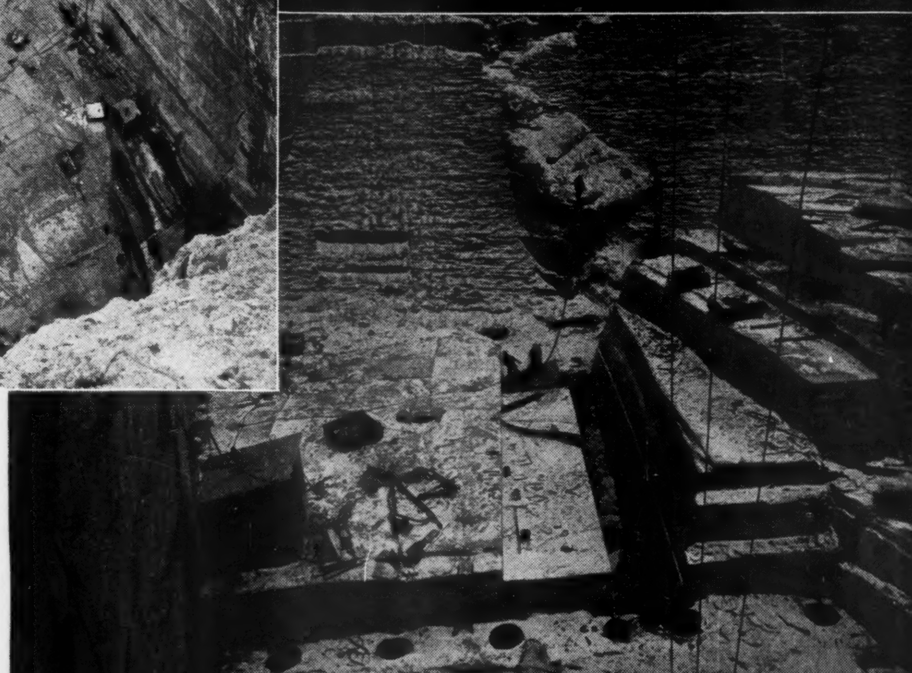
Slate Essay…

C. H. Vivian





IN SEEKING ways and means of regaining some of the economic ground it has lost in recent years, the slate-producing industry of eastern Pennsylvania is turning to research. Under its auspices, technologists at Pennsylvania State College are carrying out extensive investigations to determine what, if anything, can be done to utilize the millions of tons of waste material that have accumulated at the quarries during more than a century of operation. The inquiry is proceeding along several lines, and if any one of them is successful a new era will dawn in the Slate Belt that extends along the southern slope of the Blue Mountains in Northampton County.

In this hilly, wooded section lying at the fringe of the Pocono Mountain uplift, five and even six generations of families have produced slate that has been sent to all parts of the United States and many foreign countries. There was a time when virtually everyone in the area was supported, either directly or indirectly, by slate. Many of the quarries are hundreds of feet deep, and in one of them, which now reaches 900 feet below the surface, the bottom slate is still of high grade. The Slate Belt is a community with traditions that extend across the Atlantic Ocean, for the roots of the industry that gave it life were planted in the soil of the British Isles.

Credit for the discovery and early development of the slate deposits of Northampton County justly belongs to an English slate quarryman, Sir John Francis, although it is not of record that he reaped any profits from them or that he even saw them. Sir John persuaded a 21-year-old English lad, William Chapman, to sail for America in 1836 to prospect for slate in the states of Virginia, Maryland, and Pennsylvania. Despite his youth, Chapman was already experienced in the industry, having worked in quarries in Cornwall, Devonshire, and at the famous Penrhyn deposits in North Wales.

After wandering over considerable sections of Virginia and Maryland, young Chapman arrived in eastern Pennsylvania, where he leased a tract of land and

SLATE QUARRIES AND TYPICAL SLATE PRODUCTS

Some of the workings in Northampton County, Pennsylvania, are hundreds of feet deep. They are spanned by cableways, with drop lines for hoisting the slabs that are quarried and for lowering and raising the workers and their equipment. For approximately twenty years the primary cuts in the stone have been made with wire saws, which were first used in the Carrara marble quarries in Italy and then introduced here by way of Belgium. This method reduces waste and makes clean cuts, as can be seen at the left. Two of the tension posts supporting sheaves, over which the endless wire-cutting medium runs, are visible in the right half of the picture. These posts are usually set in 36-inch-diameter holes (foreground) that are made with Calyx core drills. Two of the views show slate roofs. The one just above is on a springhouse in Pennsylvania and has served without repairs for more than 150 years. In the illustration at the upper right slate is being made into blackboard sections.

opened up what have since been known as the Chapman Quarries. Slate production on a very small scale had previously been carried on in the area, but the industry is generally dated from the time of his appearance. We are not informed as to whether Chapman reported back to Sir John Francis; but, in any event, the news of his activities reached England quickly and was soon followed by an influx of English and Welsh slate miners to the region.

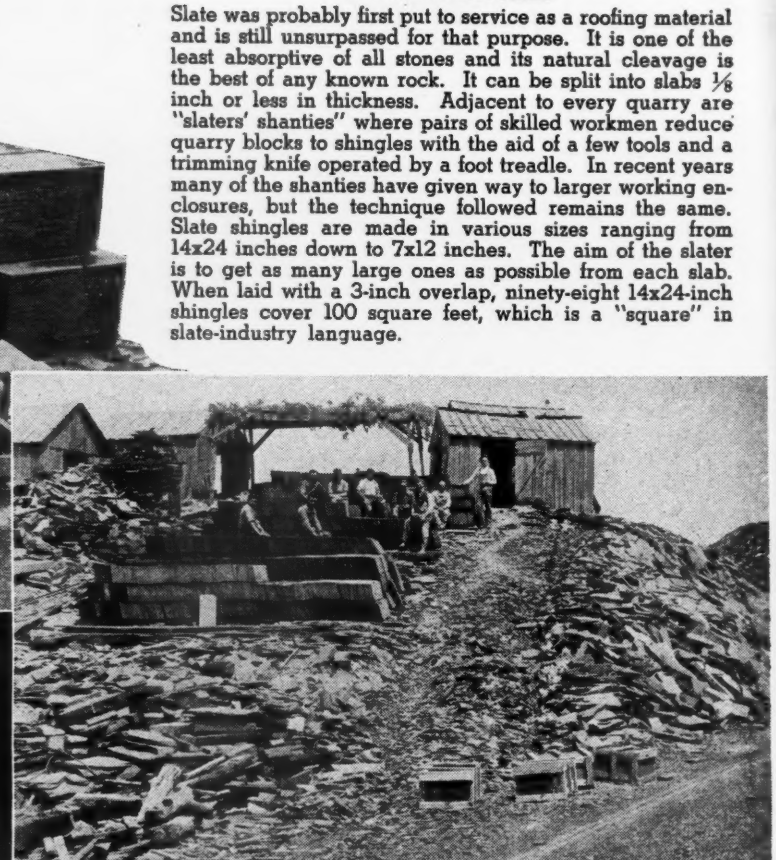
It was those immigrants that developed both the quarries and formed the nuclei of the towns that now constitute the so-called Slate Belt of Northampton County. To the two principal settlements, Bangor and Pen Argyl, they gave old-world names. The former was chosen because of the similarity of the Pennsylvania slates to those of Bangor, Wales, while Pen Argyl was named for the Duke of Argyle, some of whose descendants were among the first settlers. Along with the English and the Welsh came a sprinkling of Cornishmen whose imprint remains to this day in that their best-known dish, the pasty, can still be purchased periodically in one bakery in the district and is frequently served at the church suppers that are an integral part of the Slate Belt's community life.

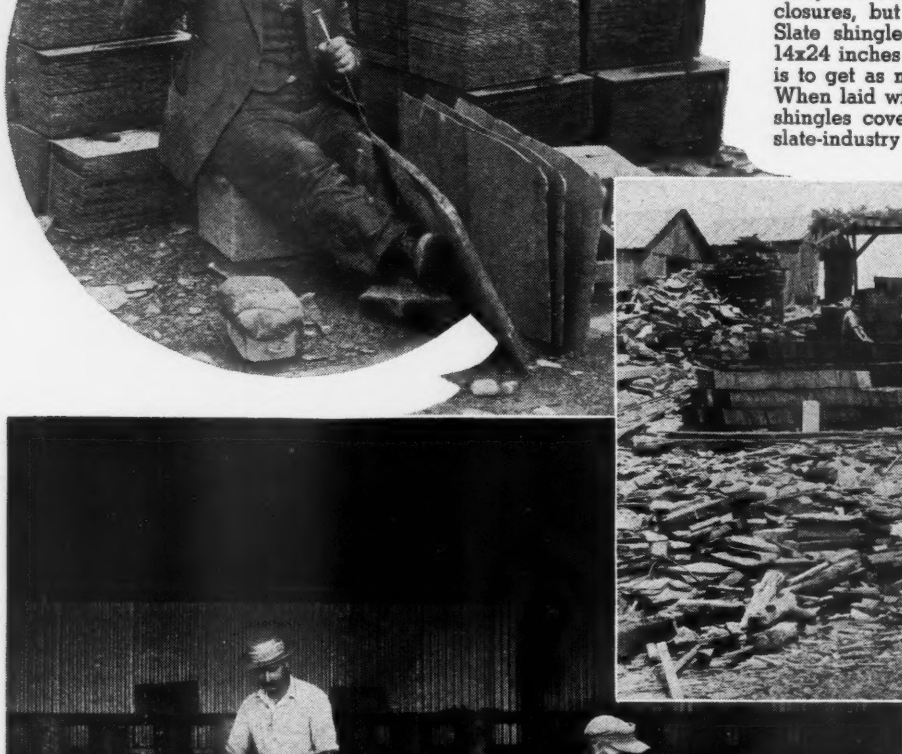
A quarter-century after the arrival of the first Europeans the Irish came upon the scene, and around 1900 a considerable number of Italians appeared and established the Boro of Roseto. Along with the places already mentioned, Wind Gap, East Bangor, and Portland make up the principal municipalities of the Slate Belt, which extends some 20 miles southwestward from a point on the Delaware River roughly 80 miles upstream from Philadelphia. In 1940, the towns enumerated had a combined population of 15,000. Of these, relatively few were then earning their living from slate, but textile works and other industries established there in the meantime created employment that has made this entire area a prosperous one despite the ups and downs of the slate industry. It is characterized by comfortable homes, attractive churches and parks, and a community spirit that can hardly be excelled in any other section of the country.

The Northampton County Slate Belt, which the Bureau of Mines calls the Lehigh District, is the largest slate-producing region in the United States. Other deposits are worked commercially in New York, Vermont, and Maine, and in what

SLATE SHINGLES

Slate was probably first put to service as a roofing material and is still unsurpassed for that purpose. It is one of the least absorptive of all stones and its natural cleavage is the best of any known rock. It can be split into slabs ⅛ inch or less in thickness. Adjacent to every quarry are "slaters' shanties" where pairs of skilled workmen reduce quarry blocks to shingles with the aid of a few tools and a trimming knife operated by a foot treadle. In recent years many of the shanties have given way to larger working enclosures, but the technique followed remains the same. Slate shingles are made in various sizes ranging from 14x24 inches down to 7x12 inches. The aim of the slater is to get as many large ones as possible from each slab. When laid with a 3-inch overlap, ninety-eight 14x24-inch shingles cover 100 square feet, which is a "square" in slate-industry language.





is called the Peach Bottom District in the vicinity of Delta, Pa., and Cardiff, Md. Once possessed of one of the most stable and prosperous mineral industries in Pennsylvania, the slate quarries have experienced numerous vicissitudes during the past quarter-century. There are two general classes of slate products: roofing and structural materials. The first obviously depends entirely upon the building trade for its market, and this is also largely true of the second. Serious inroads in slate roofing have been made by composition shingles. This was especially pronounced during the financial depression of the thirties with its attendant slump in construction. The decrease in building activity likewise adversely effected the demand for structural slate, which includes such items as blackboards, partitions for shower baths, locker rooms, etc., as well as baseboards and other interior trim.

The inevitable result was enforced retrenchment. Some companies managed to retain their identities, others remained in business by effecting mergers with competitors, while still others had to quit functioning. Statistics reveal the toll that was taken. In 1921 there were 35 plants operating; now there are less than a dozen. At the peak of prosperity there were close to 10,000 slate workers; today there are scarcely 1000. Paradoxically, the present demand for slate is greater than the supply. Not only are there fewer producers, but those that are left are handicapped by a shortage of manpower. During the lean years many slate workers drifted away from the quarries and took other jobs. Of those that stayed, some 40 percent went into the armed services and relatively few of them have so far returned to their old work. As a result, slate is now losing a lot of business to competitive materials solely because deliveries can't be made.

Slate is such a superior material for so many purposes that there will probably always be a demand for it. However, the intermediate swings that more or less follow general business cycles are not conducive to a healthy situation. Slate is a comparatively high-cost material, and with continually deepening quarries and rising labor charges the trend of costs is upward rather than downward. The industry is searching for something that will iron out the hills and valleys on its sales chart and serve as a stabilizing influence. Research would seem to point the way toward this objective.

To reduce overhead through the elimination of multiple sales costs, some co-operative measures were taken during the prewar depression period. The Structural Slate Company and Natural Slate Blackboard Company, both of Pen Argyl, became the selling agency for other producers, which continued to quarry and finish slate. There are obvious advantages to an arrangement of this kind, and they have already been found to be helpful. In 1939 another fortuitous thing happened—the election to the Pennsylvania legislature of John N. Hoffman, general mana-

ger of the two concerns just mentioned.

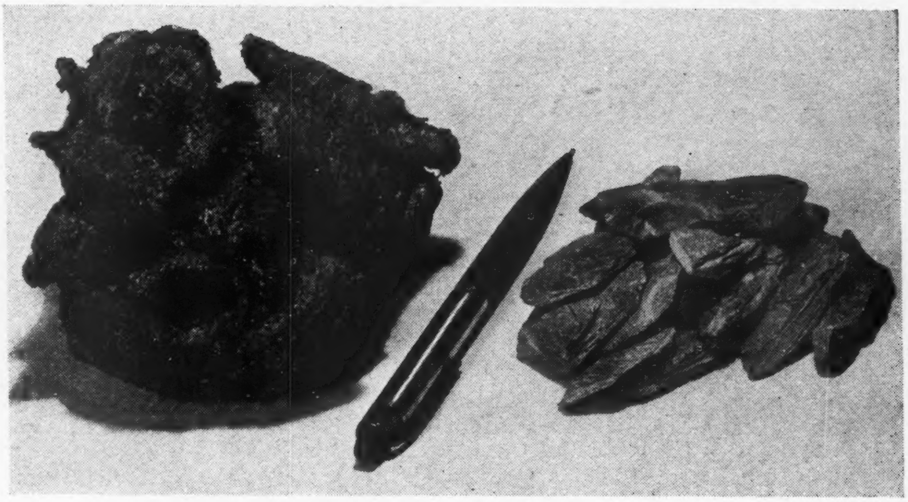
In the legislative chambers at Harrisburg, Mr. Hoffman began to acquaint his fellow lawmakers with the conditions in the slate industry and to unfold to them his theory that thorough technological investigations might disclose ways in which the mountains of slate waste could be processed or converted into forms that would give them commercial value. His appeal fell on receptive ears, which is not surprising when it is considered that Pennsylvania normally accounts for almost one-seventh, by value, of the nation's annual mineral production.

As time went on and conditions in the industry grew worse instead of better, Mr. Hoffman continued his campaign for assistance, and in the 1943 session of the body he introduced a bill authorizing a definite research program to be financed by state funds. The legislators passed the bill, which called for an initial appropriation of $35,000. In the 1945 session a like sum was allocated, bringing the total to $70,000.

The work is being done by specialists in the School of Mineral Industries at the Pennsylvania State College. The slate producers have appointed a committee of nine, headed by Mr. Hoffman, which holds quarterly meetings with the researchers to keep informed on their progress and then reports back to the industry. In connection with the movement, steps are being taken to acquaint the people of Pennsylvania with the status of the industry and the rehabilitation program that is underway. This is being done through radio broadcasts and other forms of publicity.

That the possibilities of the program are great will be understood when it is stated that 85 percent of the slate hoisted from the quarries is now rejected and goes on dumps. The methods of production have varied little in the past 50 years, and there seem to be few things that can be done to cut down wastage. Some improvement was made about twenty years ago when the wire-saw method of cutting out primary blocks was substituted for channeling, but the principal gain was in economy of operations rather than reduction in the amount of refuse. While some additional helpful measures can perhaps be instituted, a great percentage loss in quarrying and processing slate always will be inevitable. The producers recognize this and realize that the logical approach to the problem is to deal with the 85 percent that now stays on the waste piles rather than with the 15 percent that reaches the market.

If only a small part of the 85 percent that is now almost a total loss can be processed at a profit, it may result in putting the area's entire slate industry on a firm financial foundation. In fact, those identified with the program are hopeful that it will lead to an entirely new economic basis for the producers. Dr. N. W. Taylor, one of the researchers who have had the problem in hand for some months, recently prophesied a bright future for slate and expressed the opinion that only the surface has been scratched so far as its possibilities are concerned.



BLOATED SLATE FOR CONCRETE AGGREGATES

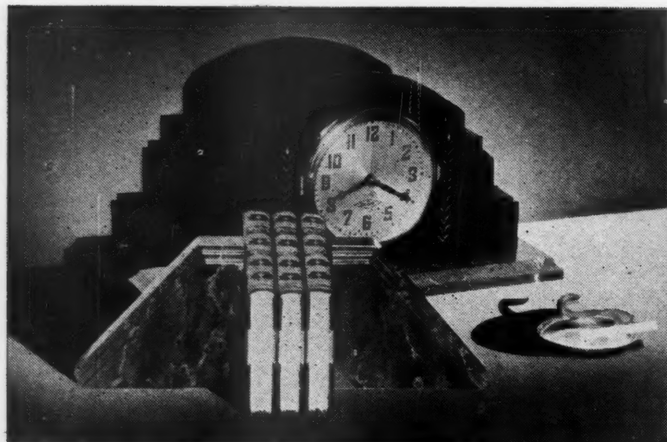
The nodule at the left was made from slate fragments of similar size, such as the pile on the right. The two weigh the same, but in the nodule the pieces have been expanded or bloated to five times their original size by calcining them in a cement-mill rotary kiln. Most of the nodules are smaller than the one shown. The bloated slate retains relatively high structural strength and can, it is believed, be put to use in ground condition as a substitute for sand in concrete where light weight is desirable.

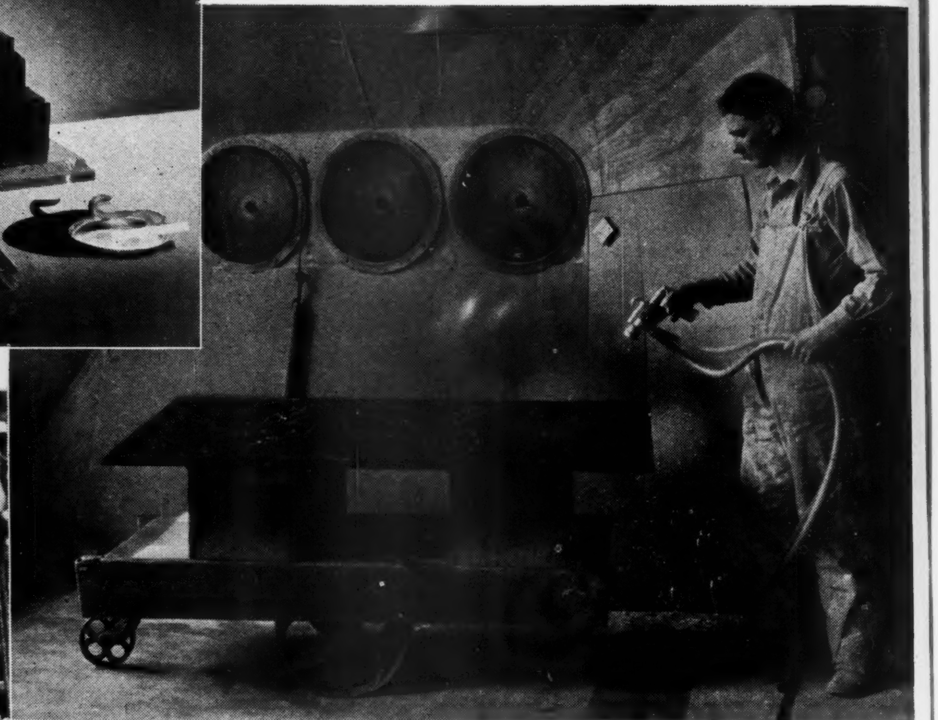
Prior to the current movement there were no important outlets for slate waste except in the forms of granules and flour. Granules are suitable for surfacing prepared roofing, but it is difficult to appraise the over-all effect of this use of the material on the slate industry because roofing of this kind competes with natural-slate shingles. Flour, or ground slate, serves as a filler in paints, asphalt surface mixtures for roads, roofing mastic, oilcloth, linoleum, and various other products. In 1942, which is the latest year for which official government figures have been published, these commodities showed substantial gains in demand over the preceding year because of their widespread military application.

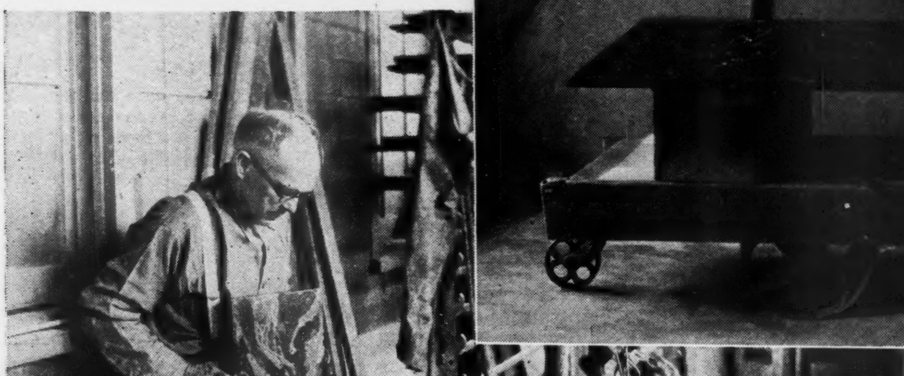
Research at Pennsylvania State College has been divided into five parts. The first four call for detailed studies of slate from the standpoint of its mineral composition and its physical and chemical properties. These investigations are in a sense preliminary to the work of finding new uses for slate waste because it is apparent that only with such detailed information is it possible to determine the material's field of usefulness. These phases of the program have been in progress since the latter part of 1943 and are now well advanced. Meanwhile, active research has been started on the development of new slate products. Thus far, attention has been mainly centered on the making of rock wool and light-weight aggregates for concrete.

The possibility of converting the material into aggregates was first investigated in Great Britain, where slate quarries have been operated for many centuries. Tests made there as long ago as 1935 indicated that certain slates could be expanded greatly by calcining them and that they would still retain a fairly high compressive strength. Upon obtaining this information, the U. S. Bureau of Mines conducted similar research work at its Eastern Experiment Station. This revealed that some Pennsylvania slates could be expanded to five times their original volume by calcining them at carefully controlled temperatures. Current efforts at Pennsylvania State College are aimed at corroborating the results of the earlier investigations and at developing suitable commercial methods for the production of aggregates.

Last spring, through the courtesy of the Alpha Portland Cement Company, tests were begun at its Ironton, Ohio, plant in a full-size rotary kiln commonly used in the cement-manufacturing industry. The raw slate was crushed to about 1½ inches maximum dimension at the waste banks adjacent to one of the quarries and shipped to Ohio in railroad cars. There it was fed by conveyor belt to the upper or cool end of a 90-foot rotary kiln. It was charged steadily at the rate of about 2.6 tons an hour, a total of 31 tons being run through in twelve hours. The temperature was varied repeatedly to determine the effect that would have on the behavior of the material in the kiln and on the quality of the bloated product. The most favorable temperature, so far as the product was concerned, was found to be around 2100°F. because a high percentage of the material obtained was light enough to float on water. Higher temperatures caused the slate fragments—es-







ORNAMENTAL SLATE

All slate produced in the Bangor-Pen Argyl district is gray, but it can be given the variegated appearance of marble or other decorative stones by what is known as the Struco process. Some designs are transferred to the slate surface by means of large copper-engraved rollers. Another method is to float pigment on water and dip a slab of slate into it, as shown immediately above. In either case, the surface is protected with a coat of lacquer that is sprayed on (upper-right). Struco slate is used for wainscoting, walls, soda fountains, table tops, radiator covers, and elsewhere about homes, offices, stores, etc. Neither the lacquer finish nor the slate itself is affected by heat, and as the lacquer is chemically inert Struco can be repeatedly cleaned without deteriorating. Various small articles such as backgammon and checkerboards, book ends, clock frames, and lamp bases also are made from slate that has been artificially colored (upper-left).

pecially the smaller ones—to get too soft and gummy, with the result that they stuck to the walls and tended to form rings that impeded the progress of the material through the kiln. Lower temperatures failed to expand the slate or produced only partial bloating. Gas was used as kiln fuel and cost 35 to 40 cents per ton of slate processed.

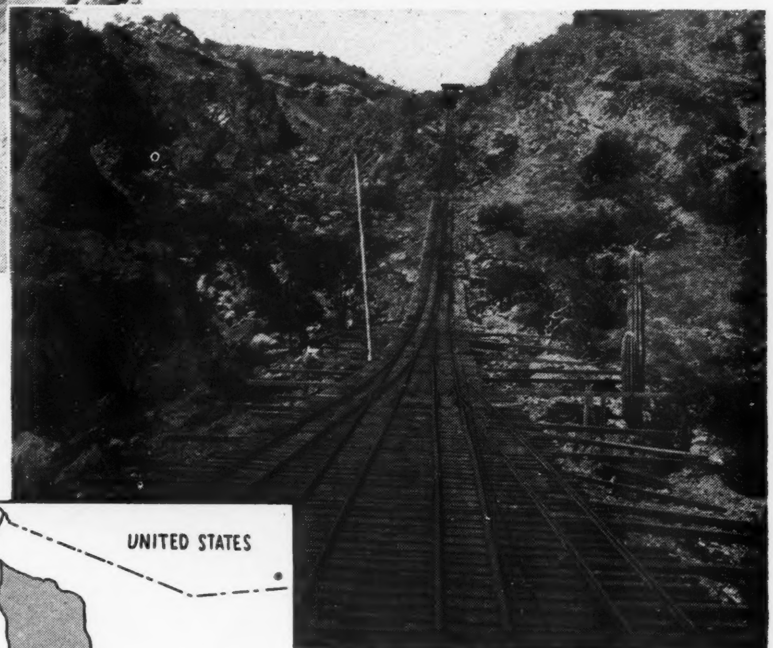
Approximately 20 percent of the material made under the varied-temperature conditions floated on water and was found to have a density of about 50 pounds per cubic foot. This led to the conclusion that a 100-percent floatable product is obtainable if all the controlling factors (temperature, fragment size, etc.) are favorable. Around 90 percent ranged from ¼ to ¾ inch in size, and less than 3 percent of the pieces were larger than 2 inches. Visual inspection indicated that the average material was very satisfactory. At present it is undergoing thorough examination in the laboratory at the college. For its use as a concrete aggregate, it is intended to grind the calcined slate to the fineness of sand and to substitute it for the latter wherever a comparatively lightweight aggregate is suitable or desirable. Similar investigations have been made of calcined shale, and slate will have to compete with it as regards both quality and cost.

The scope of the research work cannot yet be determined. The exhaustive study of slate and its component minerals previously mentioned may suggest other uses. In fact, the investigations are being conducted with that hope in mind, and no one can foretell just what course they may take as additional facts are brought to light.

Mr. Hoffman takes a highly optimistic view of all these endeavors and sees in them possibilities that go far beyond the objectives so far outlined. He believes that ways will eventually be found to make from the waste a synthetic slate with all the desirable attributes of the natural rock for most of its present uses. If that should come to pass, then the millions of tons of rejected material now heaped in monumental piles in the Slate Belt of Pennsylvania will be of economic value. The cost of quarrying and hoisting, which is the greatest expense in connection with producing natural slate, has already been paid. Thus, the accumulations would become a huge store of raw material available merely for the taking. Under such conditions it is manifest that synthetic slate would be in a very favorable position to compete with any and all other prepared materials in its fields of service. This is perhaps a dream, but Mr. Hoffman does not consider it at all fantastic.

Manganese from Mexico

Roger V. Pierce



TRAMWAY TO MINE

A 1000-foot, double-track gravity haulageway extends up a 40 to 50 percent slope from the valley to the manganese outcrop. The ore bins at the top are shown above, with openings in the manganese vein on the hillside left of them. In the picture at the right the system is viewed from the lower end.

ALTHOUGH security reasons kept it from being generally known during the war, an important and large manganese mine and plant has been under development in Mexico for the past three or four years. The new workings are located in Baja California, or Lower California, which is one of the longest peninsulas in the world. This neck of land has a length of about 800 miles and ranges from 40 to 125 miles in width. Between it and the western coast of the mainland of Mexico is the Gulf of California, from 60 to 125 miles wide.

The peninsula is divided into two territories that are separated by the 28° parallel of latitude. Mexicali, the biggest city in Lower California, is the capital of the northern territory and La Paz of the southern one. The largest towns, in the order of their population, are: Mexicali, Tia Juana, Encinada, and Santa Rosalia. We are concerned here with the area around the latter community which is in the southern division. It is some 450 or 500 miles south of Mexicali and almost due west across the gulf from Guaymas, on the mainland. Santa Rosalia now has between 6000 and 8000 inhabitants, but in its heyday it boasted a population of 15,000 and formed the center of a copper-mining industry that operated four or five shaft mines. A gradual loss of residents followed a tapering off of work in the copper mines, whose ore reserves are now nearly depleted.

The city, whose name translated into English is "Saint Rosalie," is located on the east shore of the peninsula and 50 miles from the old mission of St. Ignacio that was built by the Spaniards more than 200 years ago. Half way between the mission and Santa Rosalia is the Three Virgin Volcano, now dormant, which is known to have erupted in 1760. The area looks like a North African oasis, with thousands of date palms dotting the landscape, but the town is surrounded by volcanic mountains and the terrain is rough and the canyons are deep. All the inhabitants and the rural ranch people are friendly and hospitable. Although copper production is on the wane, Santa Rosalia is still the hub for most of the mining activity in Lower California, as will presently be told.

Considerable wild life—including small deer, antelope, wild sheep, goats, and rabbits—exists on the peninsula, and hunting is consequently good. Duck shooting is excellent along the coast. Among sportsmen, though, the region is probably better known for deep-sea fishing in the gulf, which is rated among the best in the world. The natives claim that that body of water contains almost every kind of fish from sardines to whales, all the more common varieties being abundant. Sportsmen from the world over visit the area to fish for sailfish, swordfish, marlin, and other large deep-sea species. Smaller varieties are available the year round so that, during the off-season for big game fish, it is easy to catch sea bass, rock bass, sea trout, mackerel, tuna, and others too numerous to mention.

Along with sport fishing, the gulf is widely known for its commercial output of excellent large shrimp and prawns. This industry is growing fast. The best shrimp waters are offshore from Sonora, and fishermen, trolling with nets, are busy from October to March. The boats deliver their catches to freezing plants situated along the coast of the mainland, where they are processed, packed, and

GENERAL VIEWS AROUND SANTA ROSALIA

In this area the Gulf of California is a veritable fisherman's paradise that attracts sportsmen from far and near. 1– A porpoise breaking water as viewed from the stern of a boat. 2– Fishing party poses before setting out for a day's fun. 3– One of the group, Mrs. John Loving, displays a sea trout she has just caught. 4– Messrs. Pierre Mahieux (left) and F. Garcia Quintanilla, owners and operators of the manganese property, standing on high ground overlooking Santa Rosalia. The lower section of the city and the harbor are in the background. The land is almost as dry as the gulf is wet. 5– View from the mine portal looking toward the gulf down a "river" that is normally without water. In the foreground is a cactus plant.

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shipped throughout Mexico and into the United States.

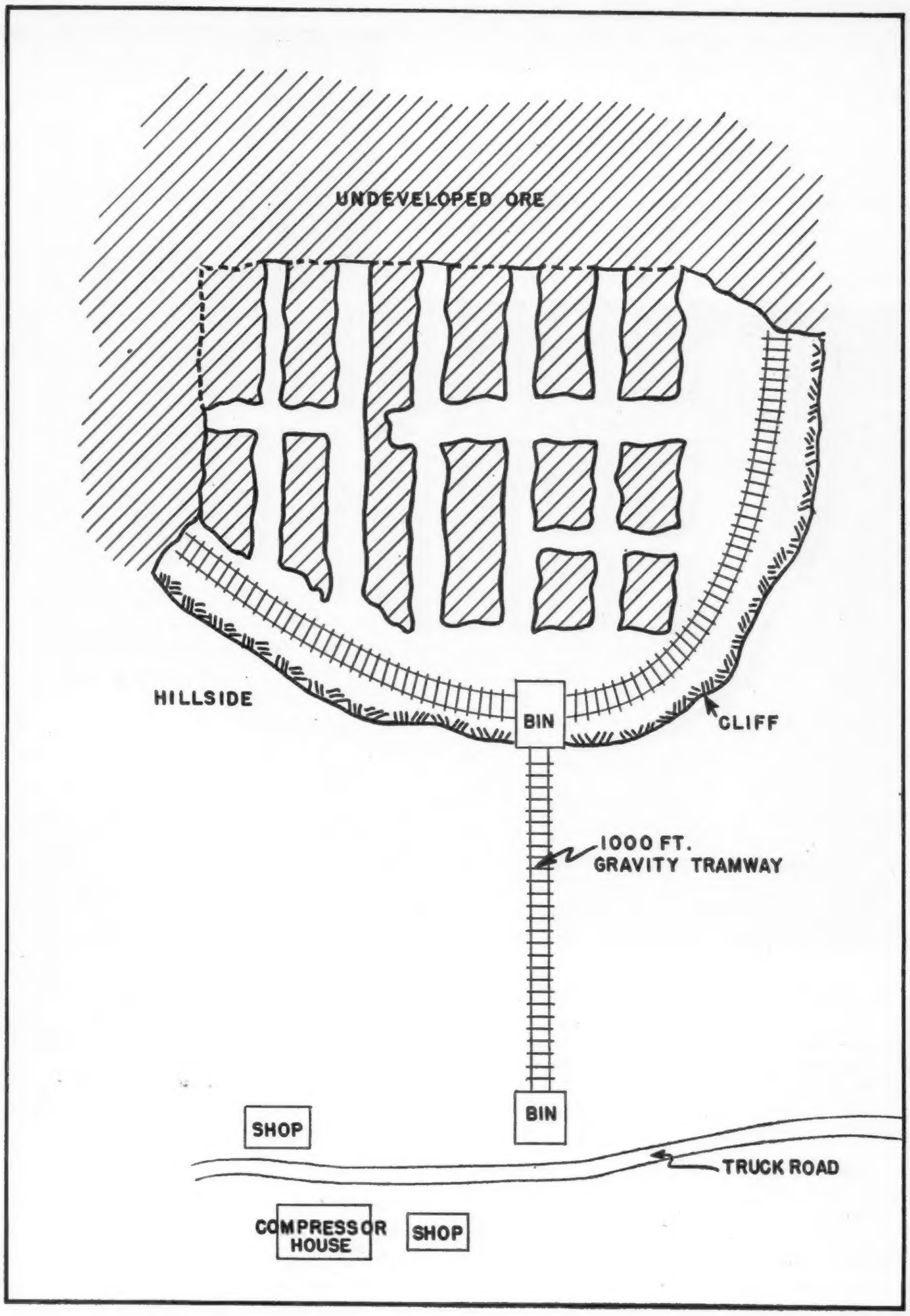
The gulf also has a thriving oyster business, and in days gone by was a pearl-fishing center. The latter work has been practically at a standstill for some time, but it is now being gradually revived because pearl-bearing oysters are again being found. A flourishing clam industry is fast developing, and lobsters of a small variety are plentiful. During the past four or five years shark fishing has become an important and profitable business that now engages numerous boats and fishermen. Large tonnages are taken mainly for their livers, which are a source of precious Vitamin A. There is year-round swimming in the gulf at Santa Rosalia, it being claimed that the water temperature is never above 85°F. or below 65°.

The peninsula is extremely arid. During a span of three or four years as little as ½ inch of rain may fall, and for several months at a time there is often no precipitation whatever. But in this region as elsewhere there are exceptions. In 1931, nearly 40 inches of rain fell in ten hours, and the peninsula experienced a similar deluge in 1945. Because of this extreme dryness, the success of industrial and mining operations depends largely upon the availability of fresh water. The supply for Santa Rosalia is piped from two sources. Some of it is conveyed approximately 13 miles from a spring in the mountains, and the remainder comes from the underground workings of the San Luciano Mine, about 6 miles distant.

The climate is tropical and many fruits are grown on the peninsula with the aid of irrigation. Dates thrive, and figs, limes, papayas, melons, grapes, and mangoes are cultivated. Some bananas are grown, although their culture has not been developed commercially. Vegetables such as carrots, peas, corn, tomatoes, potatoes, and lettuce are raised during the winter months and are obtainable from November until April. Then all greens and other produce must be shipped in. Native plant life is much like that found in the Great American Desert in the southwestern section of the United States.

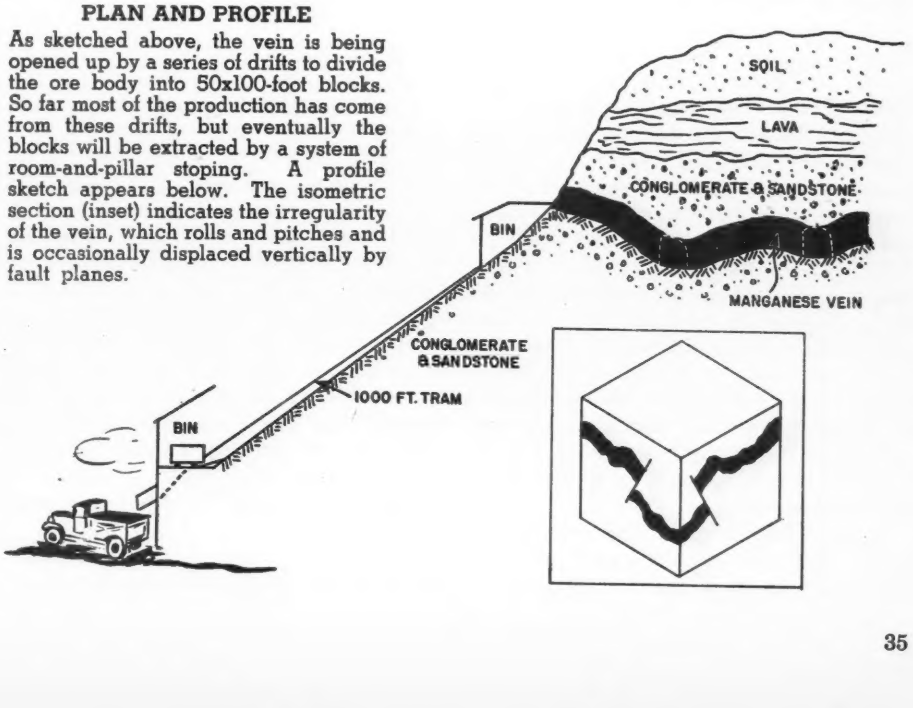
Lower California is served from the mainland by intercoastal ships, small passenger boats making the round trip between Santa Rosalia and Guaymas three times a week. Freighters, owned and operated by Cia. del Boleo, S.A., which is the original copper-mining enterprise of the peninsula, maintains a line to Pacific ports of North America as far north as Tacoma, Wash., and Vancouver, B.C. These vessels bring in supplies consisting of oil, coal, machinery, etc., and deliver the local raw minerals to smelters. The trip from Santa Rosalia around the tip of the peninsula to San Pedro, Calif., requires ten days' actual running time. Large ships make it on an average once a month.

Round-trip aircraft service from Noga-



PLAN AND PROFILE

As sketched above, the vein is being opened up by a series of drifts to divide the ore body into 50x100-foot blocks. So far most of the production has come from these drifts, but eventually the blocks will be extracted by a system of room-and-pillar stoping. A profile sketch appears below. The isometric section (inset) indicates the irregularity of the vein, which rolls and pitches and is occasionally displaced vertically by fault planes.



SOME COMPRESSED-AIR EQUIPMENT

Part of the mine's supply of compressed air comes from the 160-cfm. Mobil-Air compressor shown at the right. One of the underground uses of air is for operating mounted Jackhamer rock drills (above). In the blacksmith shop are various air-operated machines, including the I-R drill-steel sharpener at the upper right.

les, Ariz., to Santa Rosalia is now available twice each week. The transport company, Aeronaves de Mexico, S.A., is a subsidiary of Pan-American Airlines and flies Boeing 2-motored planes. The airport for Santa Rosalia is at San Lucas, which is on the gulf coast and 12 miles south of the city. Other than planes and boats, which constitute the principal means of travel north and south along the peninsula, transportation is dependent upon roads. These are passable but very poor, for it takes from four to five days to cover the 500 miles between Santa Rosalia and the United States border.

The only railroad on the peninsula is a narrow-gauge line that has about 25 miles of trackage and connects the various mines of the Boleo Company with the copper smelter. Its 55-year-old locomotives are equipped with oil burners. Rated at 100 hp. each, they handle about 100 tons of ore per trip over grades of 1 to 4 percent. It is a complete miniature railway in all respects.

The duty on imports applies only to things that also are produced on the peninsula. As these are very limited in number, it can almost be said that Lower California is a "free" zone.

Pierre Mahieux and F. Garcia Quintanilla, assistant manager and chief engineer, respectively, of the Cia. del Boleo, S.A., copper mines, are responsible for the development of the underground manganese mine and modern sintering plant. These two foresighted men discovered and laid out the mineral claims and created a market for the product; in fact, they built up the entire enterprise to its present stable position. Development was started in 1941, with six workmen and four burros. The first ore was shipped on January 23, 1942, to San Francisco, Calif. In April, 1942, a second delivery of 50 tons was made, and in April, 1944, a total of 32,000 tons was marketed. Shipments to date have aggregated more than 60,000 tons of high-grade manganese ore. Messrs. Mahieux and Quintanilla own 4000 acres of mineral-bearing land and conduct the business under the name of Mahieux-Quintanilla Manganese Company.

The ore is a bedded deposit that is inclosed for the most part in sedimentary rocks and outcrops near the top of a mesa. The vein is generally horizontal, but rolls and pitches and is rather badly faulted at some points. The dip varies between plus and minus 25 percent, the ore horizon describing convolutions that prevent it from having any consistent dip or strike. It rests on a footwall of sandstone that grades in some places into a conglomerate. The hanging wall, or overlying formation, is nearly always conglomerate. In the area now being worked the overburden has a maximum thickness of 220 feet.

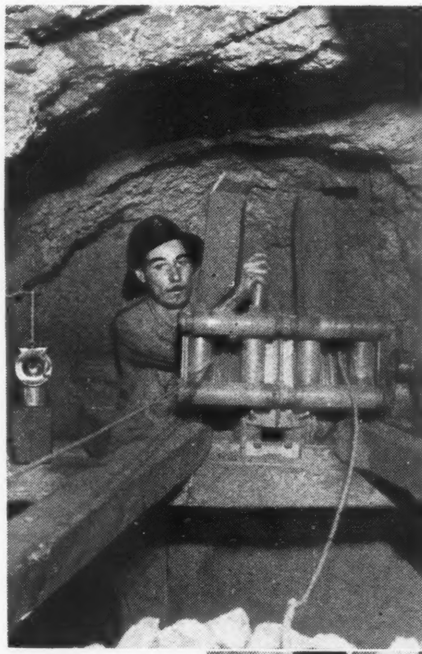
Thus far the irregular bed has been prospected for a distance of 1000 feet into the hillside. More than 200,000 tons of ore is available for mining, but the true extent of the deposit has not been gauged. Indications are that it is very large. The ore is the black oxide MnO_2 which, in its theoretically pure state, contains 63 percent metallic manganese. Output averages from 65 to 75 percent MnO_2, and many high-grade seams run up to 80 percent. The vein generally varies between 10 and 15 feet in thickness, but in places reaches 24 feet.

Two grades of ore are produced—chemical and metallurgical. The former runs 75 percent and higher in MnO_2 and commands the highest price; the latter runs 40 percent or lower. The chemical grade is segregated underground by sight selection and is shipped in crude form. It can be readily identified by its sparkling and crystalline appearance. The remainder is metallurgical grade and goes to a sintering plant. Most of it is hand sorted after it comes out of the mine to pick out any chemical-grade pieces that may still be present.

Access to the deposit is gained by means of a 2-track gravity tramway extending up the steep hillside from the valley floor. The grade varies from 40 to 50 percent and the system is about 1000 feet long. Fifteen men labored for three months to construct it over the rough and rocky terrain. The slope was so great that burros could not be used to carry the materials, and all of them had to be packed up by the workers. The tracks are of 20-inch gauge, the same as in the mine, and of 24-pound rails. Only ore and supplies are transported on the haulageway, persons being prohibited from riding it.

In general, the deposit is developed by driving haulage drifts in the vein. These follow the bottom of the ore, whatever its dip may be. Drifts are 8x9 feet in cross section and are spaced about 50 feet apart. These openings serve to divide the deposit into a pattern of blocks that measure 50x100 feet and form the basis for a room-and-pillar method of mining. Most of the present production is obtained as a result of the primary work—the driving of the development drifts. Later, the blocks will be cut into sections and removed with scraper hoists. This plan will permit final extraction of the entire ore body. All the work now being done or projected calls for a high degree of mechanization, with a maximum use of modern equipment, much of it driven by compressed air. Indications are that future operations will be as efficient as those of any mine confronted with similar conditions.

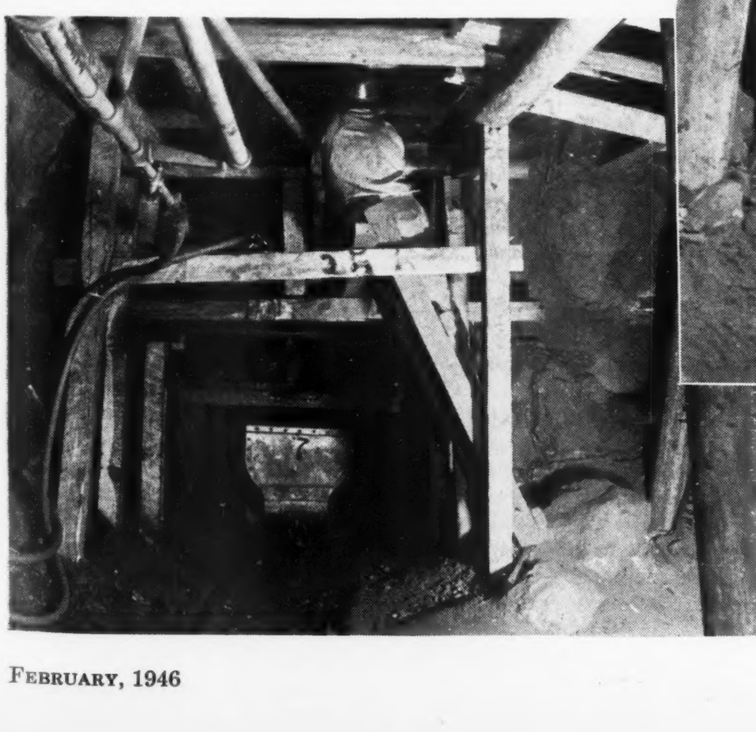
The drifts are advanced with mounted JB-4 and JB-5 Jackhamers using ⅞-inch hexagon drill rods and 4-point Jackbits. Two men, for the most part, drill, load, and blast a round from a face per shift. From twelve to fifteen holes are put in per round and blasted with 30-percent dynamite in 1¼-inch cartridges. Holes drilled in the softer low-grade ore tend to cave, and it is difficult to realize the full effectiveness of the explosive. Consequently, an average round pulls only about 3½ feet, whereas 4½ to 5 feet are usually broken in the harder high-grade ore.



At present, where the footwall is reasonably level, the material is loaded by hand shoveling, but this work will soon be done by Model 12B Eimco air-operated mucking machines. Where the bottom is inclined, with either plus or minus slopes, new lightweight Ingersoll-Rand A5NN0H, 2-drum air hoists pull scrapers that move ore directly from a bench either up or down the undulating surface into a chute or cars, or up a ramp and into cars. These hoists are standard equipment in all such production areas and do the work of digging, transporting, and loading in one step instead of the three that would otherwise be necessary.

No timbering is required so long as the ore is not removed clear to the hanging wall. In other words, if a small bridge is left in place overhead frozen to the country rock it supports the conglomerate roof or back. In mining the thicker ore sections the lower part of the vein is taken out in the manner just described, while the ore that remains above the drift is brought down by drilling with stopers.

The broken ore is loaded into ½- to ¾-ton cars, and these are either hand-trammed or hauled out by mules. From the portal to the head-house bin at the top of the gravity tram they are pulled by mules. Future plans provide for the use of high-speed, electric-driven belt conveyors that will deliver the ore from the underground workings directly to the bin. Scraper hoists will move the ore from

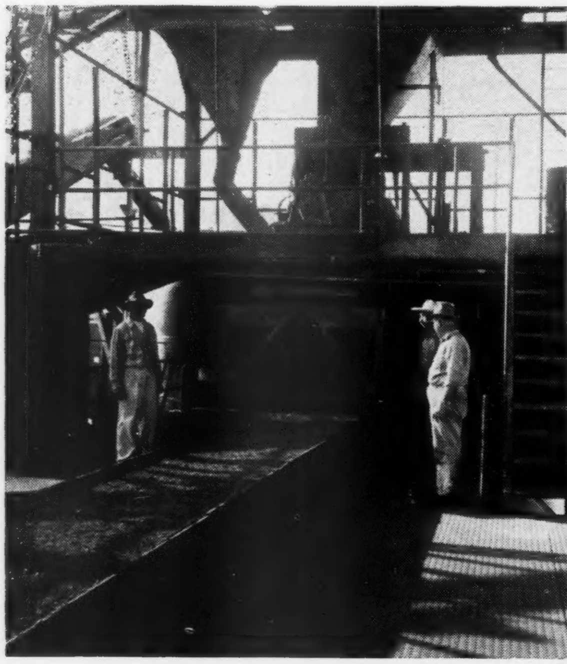


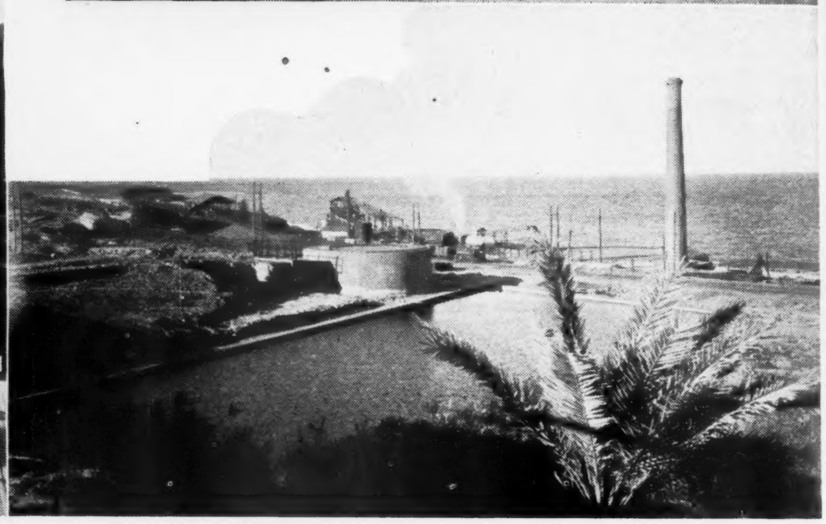
SCRAPER LOADING

Where the floor is fairly level, ore is now loaded by hand shoveling. However, for the most part the vein follows a highly undulating course, and in these areas the ore is moved up or down inclines and into cars by scrapers (above). The latter are drawn by Ingersoll-Rand lightweight, 2-drum air hoists (top). One of the different loading arrangements is shown at the left. Here the scraper is pulled up a ramp to a platform, where it discharges into a car spotted underneath.

SINTERING PLANT

The low-grade ore is transported from the mine to Santa Rosalia, where it is sintered to form a product containing 52 to 54 percent manganese. At the lower right is a general view of the sintering plant and, below, a part of its interior and of the sintering belt. The product is stockpiled by a belt conveyor (right), and from the accumulated supplies periodic shipments are made by boat. All the sinter is used by steel mills in the United States.





the various production areas onto the centrally located belts. The highly flexible gathering and loading units or scrapers are well suited to an operation of this nature, as they will work effectively regardless of the involved pitching, folding, and faulting of the vein.

Upon being brought out of the mine the ore is run over a belt conveyor, where it is hand sorted. Then it goes to the storage bin at the head of the tram, and at that point is loaded into 1.6-ton skips for lowering to the valley. The tram is a counterbalanced haulageway that works entirely by gravity, a loaded car on one track pulling an empty up the other track. A ⅝-inch wire rope connects the cars. The system can lower 150 tons of ore in an 8-hour shift.

At the bottom of the tramway the ore is dumped from the skips onto a screen beneath which are bins. This separates it into two sizes—fine and coarse. These materials are trucked separately to the railroad terminus where they are loaded into cars for transportation to the Dwight-Lloyd sintering plant at Santa Rosalia. There the coarse ore is crushed to ½-inch size and fed onto a conveyor belt, the fine ore going directly to the conveyor. Coke breeze, shipped from the Kaiser Steel Company at Fontana, Calif., is crushed to minus ¼ inch and delivered to the belt carrying the ore. This combination is then elevated to a bin and mixed with water in a pelletizer. The product is fed to a diesel-oil-fired sintering machine the fuel for which is received by boat from San Pedro, Calif. Coal required for the plant is obtained either from California or from Mexico.

The sintered ore drops onto a ¼-inch screen. Material that passes through it is returned to the head end of the sintering machine, as is dust that is collected from the latter by a cyclone separator. Great effort is made to keep the sintered ore free from dust, and the resultant clean product has led to the receipt of steadily increasing orders. The finished sinter, which contains from 52 to 54 percent manganese, is conveyed to stock piles and there spread by a scraper, being accumulated preparatory to periodic shipment by boat. For the loading operation the scraper is reversed, the sinter being pulled from the stock piles into trucks that haul it to the freighter. In the case of the latter work the material is handled at the rate of about 1500 tons every 24 hours. Shipments usually run 5000 tons per boat. The sinter is consigned to steel mills in the United States.

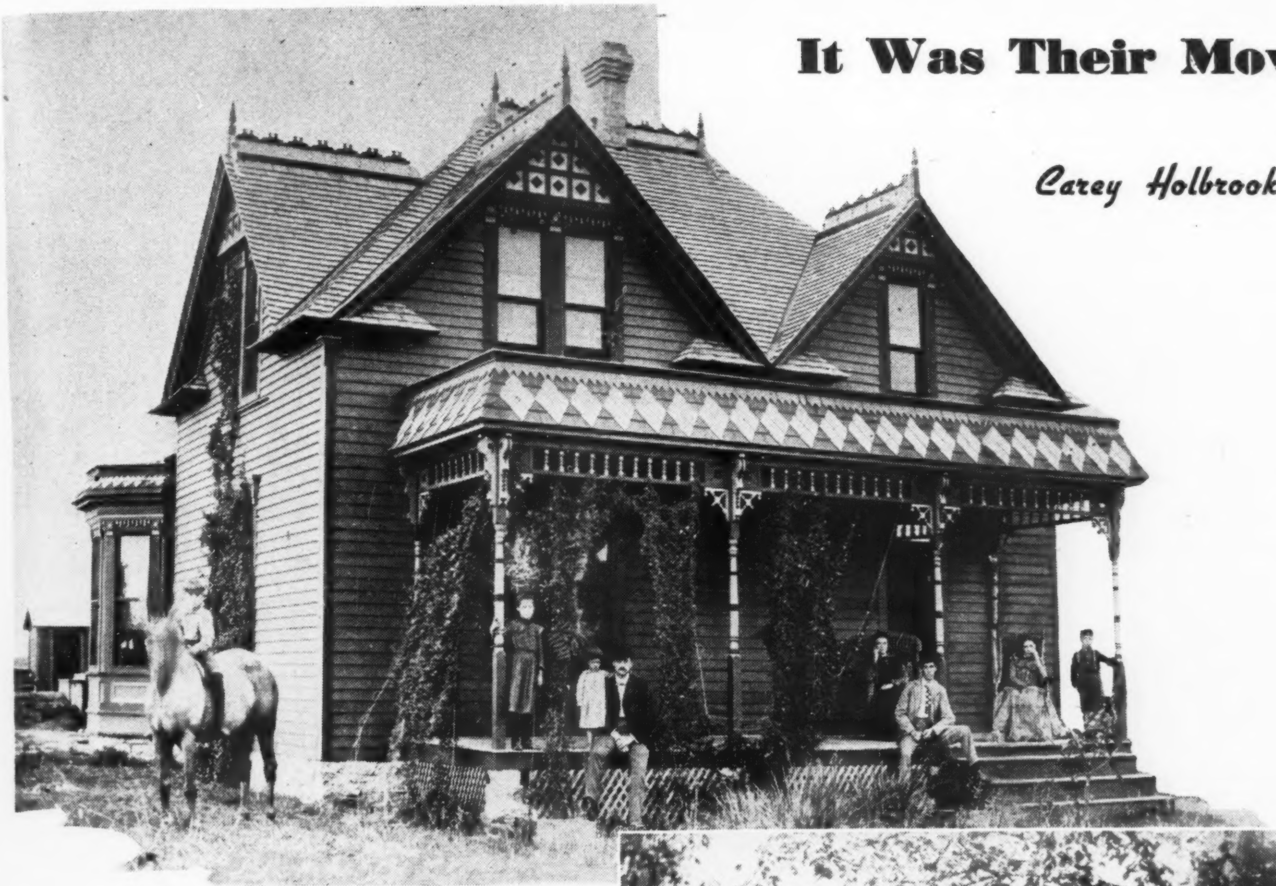
The plant can produce about 7 tons of coarsely sintered manganese an hour, or more than 150 tons a day, but its full capacity is not now being utilized. The mine yields around 60 tons daily on a 2-shift basis and is worked six days a week, except when special shipments are being made. It is evident that the present sintering facilities will be able to handle a considerably greater tonnage in the future as plans to increase the mine output mature.

Compressed air for the mining operations is supplied by two Ingersoll-Rand compressors—a Type XRB that is belt-driven by a diesel engine and an HK-160 portable unit. Together, they furnish about 700 cfm. They are located in the valley, near the lower terminus of the gravity tramway. At the same place are blacksmith and repair shops and a plant for reconditioning Jackrods and Jackbits. Air-operated equipment in the latter includes an I-R No. 54 drill-steel sharpener, a Jackbit grinder, and a shank grinder. Water for drilling and for domestic use is obtained from a spring about half a mile away and is pumped to the mine. Although the peninsula roads in general are poor, as already mentioned, the stretch between Santa Rosalia and the mine is kept in excellent condition, as all supplies are trucked in.

Messrs. Mahieux and Quintanilla are mechanizing their entire workings and improving their methods as fast as possible so as to continually increase the output. They are marketing a clean, high-class material, and the indications are that their property will be a dependable source of high-grade manganese for many years to come. The product is already in a position where it can compete with that from any other known source of manganese.

It Was Their Move

Carey Holbrook



A HOUSE THAT WAS MOVED

Until August, 1903, the town of Mountain View, Okla., had spent its entire life of four years in Washita County, on the northern side of the Washita River. Then, because of unusual circumstances that are set forth in the accompanying article, it was picked up, lock, stock, and barrel, and transported southward a good mile across the stream into Kiowa County, where you can find it today. One of the 200 or more houses that made this strange journey is pictured here. It is shown above as it appeared in the "old town," where it was the home of A. E. Stinson, a partner in a hardware business. The other view shows it as it looks now surrounded by trees and shrubbery. Mountain View is on the Rock Island Railroad, and the 1940 census gives it a population of 1075.

RED dust lay deep on the roadway that day, and the weeds crowding the wheel tracks hung heavy with a fine powder that swirled and eddied into open doorways. Drooping in the heat of an August sun the countryside lay parched and thirsty, and teams fording the Washita stretched their necks to drink, then splashing across strained and tugged up the steep bank, leaving behind them a ragged trail of water that fell from wheel and fetlock. Ordinarily the scene would have been a peaceful one. Wide-hatted men would ride by with a jingling of spurs, dip into the ford, then silently disappear around some bend, their barefooted horses moving easily in a jog trot that ate up distance. A few wagons would come and go. A few people on foot. Normally life ran slowly under Oklahoma skies when August blazed.

But this was no ordinary day, this August of 1903. And this was no ordinary event that was happening to the hard-bitten town calling itself Mountain View. This was moving day for a lean and hungry frontier community that boasted of 25 or 30 business buildings, more than 200 frame houses, and a flapping assortment of tents and lean-tos, all located on the wrong side of the river. Across the Washita, more than a mile away, gleaming rails told the story of a railroad pushing its way West. And Mountain View was going to those rails, lock, stock, and barrel—men, women, and children—church, store, and bawdy house. Here was an entire town whose buildings were sprouting wheels.

The beckoning lure of the new railway was not the only reason why Mountain View was on the march. A graver crisis was whipping it into action. The thrifty citizens, while digging around among the more or less jumbled records of a bewildered land office, had discovered some facts that sent them scurrying to the nearest joint for something red and bracing to quiet their frayed nerves. And in Mountain View they didn't have far to go to find a joint. Briefly, what they had discovered was that they had no title to the land on which they had built. More than that, they were located in a no-man's land—on a strip that some cockeyed surveyor had misplaced when he made the original survey. There they sat right between two counties but situated in neither of them. About the only solid fact they had to comfort them was that they were at least in the United States, and even that knowledge began to give them a headache when the word got around.

Over into Texas, Kansas, and Arkansas the news spread of a town located in lawless territory, and the hard-eyed gentry stirred in their hiding places and set their faces toward a haven where they could thumb their noses at the law. Into that

FIRST BANK AND PRESENT ONE

In 1903 it was the Washita County Bank; now it is the First National Bank. It has always been pretty much of a family institution—a family named Kobs. A. E. Kobs started out with it as cashier and now he is its president.

lost strip where Mountain View squatted on the banks of the Washita flocked the bad men from surrounding states. Here was rich pickings for them, with no county or state laws to cramp their style. The only court they had to fear was the United States Court at El Reno more than 75 miles away. The only peace officers liable to interfere with them were United States deputy marshals who were already so busy hampering the operations of criminals over a wide and sparsely inhabited country that they had little time for one small misplaced settlement like Mountain View. So the place busted wide open!

For four years—since 1899 when the first hardy pilgrim pitched his tent on the townsite—Mountain View had suffered the birth pangs of a frontier community. Along her dusty streets men had died to the music of barking six guns. Children had come into the world without the benefit of antiseptically protected delivery rooms. A Methodist church had sprouted to offset the influence of seven saloons and an unknown number of gambling joints. A schoolhouse had been built by popular subscription, and a teacher employed who was paid by the same method. Stores and eating places had come to the town. A bank had been established by the Dunlap brothers, with A. E. Kobs as cashier.

For four turbulent years Mountain View had been working its way out of infancy, and now, having reached the age of lusty youth, its good citizens learned to their dismay that they were roosted on a strip of land to which they had no title. And the only solution they could find to their problem was to get out of there as fast as they could and locate on land they could prove they owned. That land lay across the river in Kiowa country, and soon the whole town was on the move. Ahead of them the settlers saw security for homes and business buildings and the protection of local and state laws. Behind them they left many a crimson-splashed page of frontier history that lives only in the memory of white-haired men and stout-hearted women whose race is now almost run.

Kerosene lights were blazing in a saloon in Mountain View the night the law walked in on Deaf Jim Williams, his brother Mart, and a Cherokee Indian named George Carr. Jess Morris was the law, and with him were Walt Hughes and an unnamed barber who had been deputized along the way. No one knows what crime had been committed. Horse stealing perhaps, or selling liquor to the Indians. At any rate, Deaf Jim and his brother knew exactly how to handle themselves when the law crowded them into a corner.

When the guns began to blaze, six men were throwing hot lead at one another. When the guns were empty, five of them were on the floor. George Carr had a bullet through the eye, both legs were riddled, and he was shot through the body. He crawled into a cornfield and lay for several hours before he received medical attention. He got well! The slug from a forty-four tore into Deaf Jim Williams's temple, paralyzing the optic nerve and coming out on the other side of the head. As he lay there, blind and bleeding, he swabbed out the hole with a red bandana wrapped around a lead pencil. Deaf Jim not only lived to tell the tale; but through some mysterious medical process recovered his hearing. No clanging ambulances carried the other wounded men to hospitals; but the rough hands of frontier doctors patched them up, and the sturdy breed went on. Mountain View citizens were hard men and they lived in a land that was raw and rough.

The whole town was underway that August day in 1903. The wheels that carried many of the buildings along in their halting progress were made of sections cut from huge cottonwood logs and were fitted with crude axles. Skids, too, were used for some of the smaller structures, the clank of chains echoing as the caravan moved on its way. High above the Washita a crude bridge stretched from bank to bank. Sprawling and ungainly it lay across the stream supported by massive piling of walnut, cottonwood, and elm and boasting of no protective side railing. The span had a house-size job to do, and it stood up unyielding under the loads that inched their way across its rough-hewn floor boards. Within the buildings life went on. Children peered from doors and windows, played by the roadside, and then caught up with their homes in time for dinner. Mrs. Roy Marion Sohn whose husband owned the hardware store looked out on the straining backs of the teams as they pulled her house to the new location that was waiting for it across the river.

On the dusty streets that were being left behind, ragged rock piers marked the site of the Stinson & Lamberson store with its scarred and battered counters and smudges on the walls that could well have been made by eggs flung by the unsteady arm of old Dock Quarrels who sometimes tarried too long in Big George Gordon's saloon. Dock Quarrels was in a playful mood one day when he stepped into Stinson & Lamberson's fairly well lit up. In front of a counter stood a tubful of eggs,

smooth, white, and tempting. Somewhere back in his befuddled brain the idea was born that it would be a fine joke to fill a hat with eggs and jam it down over its owner's ears. That was the way the egg fight started, and it only ended when the ammunition was exhausted. The place was a mess when Arch Stinson finally crawled out from under the counter wiping his face where a fast-breaking curve had caught him just as he ducked. By that time Dock Quarrels was weaving his way home, but the next day he was back to settle for the damage his escapade had cost the store. Mountain View men were rough when the town was young, but they were always willing to pay for their fun when they sobered up.

In the making of a frontier town there are certain essentials that must be provided for the leather-faced customers. High up on the list is a place where liquor can be bought. So it is not surprising that the first merchant to open up for business in Mountain View was Big George Gordon, whose lot was the first piece of property to blossom forth with a tent. Somewhere in the string of buildings that crawled along that moving day was Gordon's saloon, open for business. But that was back on the road; at the new site the tent took care of thirsty customers. Big George also was a roving gambler, and the area he covered extended into the Cheyenne and Arapahoe country to the north, the Kiowa and Comanche region to the south, and the land of the Caddo Indians east of Mountain View. This was the Indian Territory, and stern laws were on the statute books to protect the tribes from bootleggers and gamblers who found their red brothers ready for the picking. With the approach of the balmy days of late summer, Gordon and Eat-em-up Jake, his partner, rode forth to the harvest, law or no law!

Eat-em-up Jake had another name, but nobody knew what it was. Folks claimed that he lost it in a poker game. Somewhere back in his lurid past he found himself holding five aces in a game where the stakes were high. A certain one-eyed gambler sitting in also discovered that Jake had one too many aces in his hand, which was very, very bad business. Despite his handicap he got to his gun first, and it wasn't long before Jake was lunching on the ace of hearts urged on by a big black forty-four stuck in his ribs. And when Jake had swallowed the last morsel his name became Eat-em-up Jake and stayed that way.

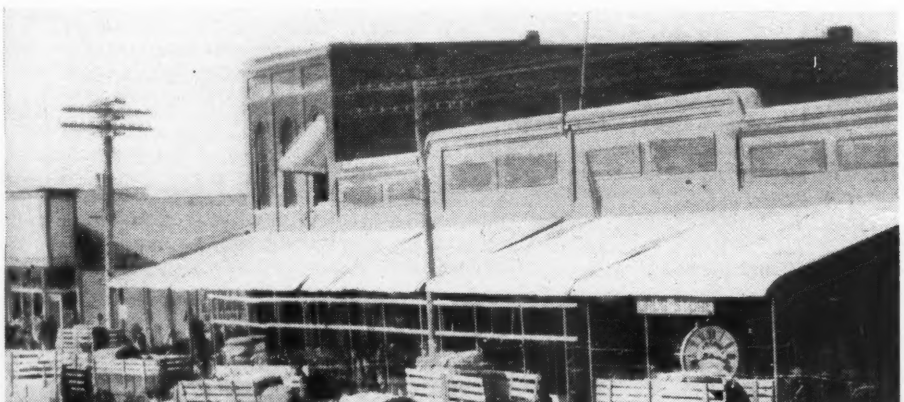
Dividing up the loot gathered on these trips into Indian country was generally a simple matter. "You take this pinto, and I'll take this sorrel. Here's a blanket for you and one for me. Want this spotted yearling? The read yearling suits me." But on occasions there were complications, as in the case of a particularly valuable saddle that had served a Kiowa chief. The argument between the partners was a long way from being settled when Eat-em-up Jake went home to sleep on the matter. But it was all cleared up the next morning when he strode into Big George's saloon, threw the front half of the saddle on the bar, and remarked, "There's your half of that saddle you Indian robbing so-and-so!" He had cut it in two with an ax! In spite of the many notches on Big George's gun, he died peacefully in his bed some place in Texas.

But to get back to the big move. The Methodist church and the school had to be sawed in two because they could not be transported any other way. The post office also creaked along. There was a time in the history of Mountain View when shifting the post office from one site to another was purely a local affair—the sacred corridors of the U. S. Postal Service were far removed from the red banks of the Washita in the nineties when the lusty town acquired its first post office. A few miles away across the river stood Oakdale where Mountain View folks got their mail. Mountain View wanted that post office, but without going through the devious legal process necessary. Of course Oakdale wanted to keep it, but lost it through a ruse.

There was a certain road in those parts that the Oakdale folks wanted relocated, so when a paper showed up in their community headed "Petition To Move Road," they signed it freely. It wasn't long before it bobbed up in Washington, and I'm a son of a gun if it hadn't turned into a solidly supported plea to the Post Office Department to move the post office from Oakdale to Mountain View. But not waiting for red tape to unravel in Washington, a committee of Mountain View citizens called at the Oakdale post office, routed Charlie Snow the postmaster out of his straw tick, stuck their petition under his nose, and loaded the whole business on a wagon. There wasn't any gun play, because the whole operation was done on the up and up, but even in the faint light from flickering lanterns suspicious bulges could be seen on the hips of the shadowy figures that came and went. The next morning Postmaster Snow was dishing out postal cards and mail-order catalogues from a room in the back of the bank across the river, and for months mail coming to the city was addressed to Oakdale Postoffice, Mountain View.

More than 40 rushing, turbulent years have swept by since the last lurching house from the old town of Mountain View settled down in its new location on the railroad. The frame business buildings that made the trip have been shoved around by the march of progress until few of them remain. Solid brick structures make up the main street. The original bank still does business, and its officers still bear the name of Kobs. Mountain View has become a substantial, prosperous little city.

Over on the other side of the river nothing remains to mark the spot where the town once stood. But anyone with ears tuned to the right wave length can hear things along those weed-grown ways. Soft winds blowing through the cottonwoods along the Washita will bring with them the ghostly creak of rough wheel on axle and the acid smell of sweating horses. High on the bank of the stream a crude bridge will spring to life and across it the shadowy shapes of houses will make their way slowly, haltingly, but moving ever onward to a new location calling to them from across the river.

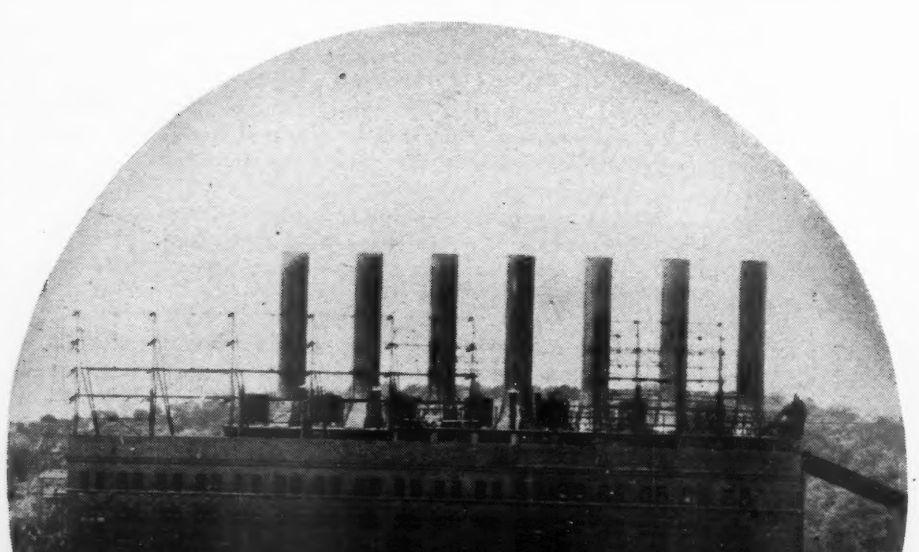


EARLY MAIN STREET SCENE

A section of the business district of the town as it looked a few years after it had been transplanted across the Washita. The high-bodied wagons were used to haul farm crops of which cotton was the most important.

Air-Operated Combustion Controls

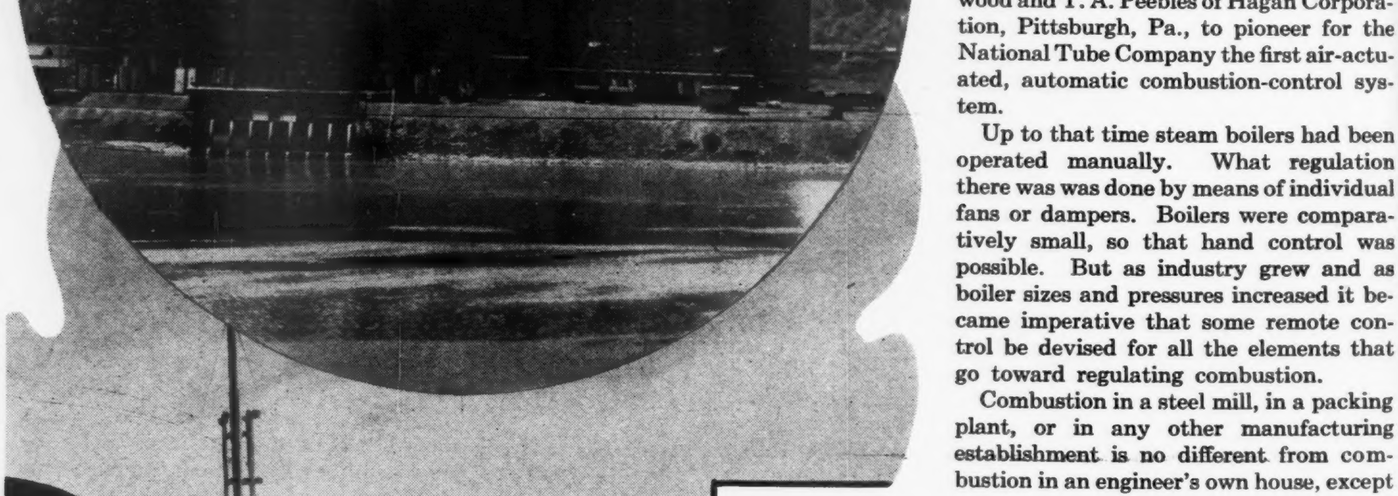
Harry Stanley



PEOPLE mostly think of compressed air as a medium that is used to operate pneumatic tools and appliances and railroad braking systems or in lifting heavy loads. Many do not realize that it is also instrumental in making extremely sensitive measurements such as are required in automatic combustion-control systems. Today, 90 percent of all such systems for steam boilers—industrial, utility power plant, and marine—are air-operated, as opposed to water or oil. But there was a time, back around 1918, when compressed air had never been tried for this purpose, when its use was deprecated. During World War I, it fell to J. M. Hopwood and T. A. Peebles of Hagan Corporation, Pittsburgh, Pa., to pioneer for the National Tube Company the first air-actuated, automatic combustion-control system.

Up to that time steam boilers had been operated manually. What regulation there was was done by means of individual fans or dampers. Boilers were comparatively small, so that hand control was possible. But as industry grew and as boiler sizes and pressures increased it became imperative that some remote control be devised for all the elements that go toward regulating combustion.

Combustion in a steel mill, in a packing plant, or in any other manufacturing establishment is no different from combustion in an engineer's own house, except



ON LAND AND SEA

Modern central-power-station boiler plants are huge structures, and even with elevators to carry men from bottom to top it would be next to impossible to operate them manually. Instead, that is all done with air-actuated mechanisms that respond instantly to changing conditions and perform the manifold functions unfailingly. In the West Penn Power Company station (above) the vertical distance from ground level to the fan floor is 130 feet, the equivalent of 10 or 12 stories. Combustion control of ships' boilers was vitally important during the war for it prevented smoke from issuing from stacks and thereby kept lurking enemy subs from detecting them at considerable distances.

for the size of the job. At home he may fire his furnace with coal to get heat. The only way he can make the fuel burn well is by mixing air with it in just the right proportions by adjusting the draft dampers. If there is too much air, the coal is consumed too fast, and a large volume of heated air is wasted. If there is not enough air, the coal and its gases do not burn efficiently, and fuel is wasted. The general assumption is that all we pay for is the fuel, but actually we are paying for air, too.

With reference to utilities power plants, which played so large a part in war production, many of us are apt to forget that while these stations are huge, the principle on which they operate is extremely simple. A power plant is nothing more than a machine burning coal to create heat inside a boiler. The latter has tubes filled with water which is converted into steam. The steam is forced at high velocity against the blades of turbines, which operate generators to transform the force into electricity. This is transmitted over wires to the consumer—to light up his home and to run his wife's appliances. What has happened is that a pound of coal has been changed into a different form of energy.

The crux of any combustion-control system is the correct proportioning of air and fuel. This not only averts smoke but it saves fuel and gives the utmost in heat values per pound of coal. Once this could be done manually in an imperfect way. But today's steam boilers are sometimes from seven to ten stories high and, while they have elevators for repair crews, it would be fantastic to expect men to shuttle up and down to adjust dampers, forced-draft fans, or induced-draft fans in the small intervals of time permissible, less than 30 seconds. The fully automatic system responds instantly to any change in demand for steam. In short, fans and dampers and regulators are all synchronized and move in unison at the least variation in any of the operating conditions.

Air under pressure is the sensitive signaling system which warns of each change. Air also acts as the force which, by pushing a piston up or down, motivates the controls and sets in motion the closing of a damper, the increase or reduction in the speed of a fan, and the adjustment of a diaphragm regulator. For the signaling function of a Hagan control system, compressed air at approximately 60 pounds pressure is used. The various mechanisms, which require a positive, stable force, are operated with air at possibly 80 pounds pressure.

The first Hagan system was air-operated for definite reasons which T. A. Peebles, chief engineer of the corporation, had long harbored. It was the opinion that air was the best medium for transmitting impulses accurately and sensitively. Water was ruled out because it freezes and also corrodes lines. Because of its physical changes it could not be regarded as stable under all operating conditions. Oil hydraulic systems also were out of the question because oil is heavier than air and the pressure in a line would vary somewhat, depending upon the vertical position at which measured. Further, there was the danger of fire, which air does not involve.

To understand the need for today's automatic control of combustion one has only to consider the primary function of a steam boiler—the production, with safety, of a required amount of clean, dry steam at practically constant pressure with a minimum of fuel, a maximum percentage of availability, and at low repair and operating cost. Since fuel is a large item in the cost of raising steam, the efficiency with which it is burned is important. In his own home, the engineer might put on a shovelful or two of coal at a time. But many a plant today uses 500 tons a day in a single boiler furnace. To burn fuel efficiently, therefore, it is necessary to do four things:

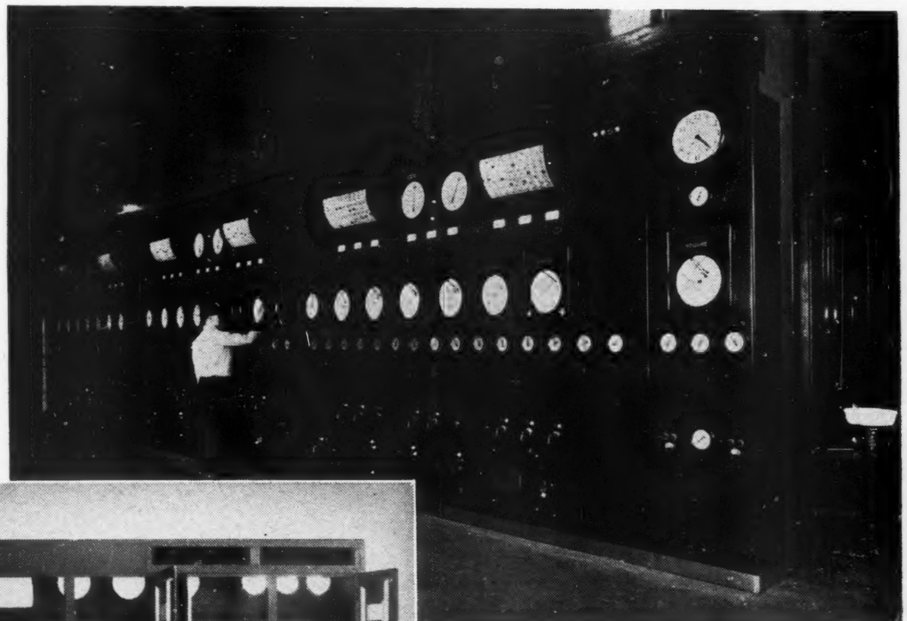
1–Introduce fuel and air to the boiler or furnace in the correct proportions and in proper relation to load demands.

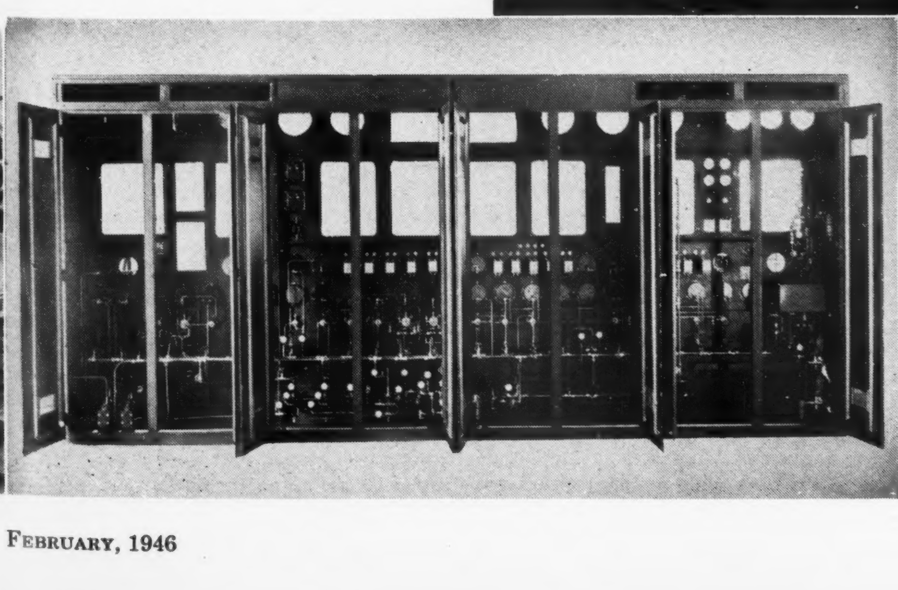
2–Divide the plant load properly between the boilers in service.

3–Limit air infiltration to a minimum.

4–Prevent unnecessary fluctuations in steam pressure, forced draft, furnace temperatures, superheat, and water level.

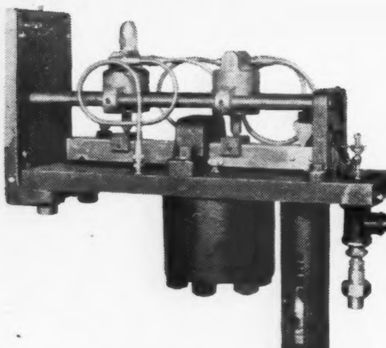
One of the biggest combustion problems that industry's engineers have had to face is the burning of several fuels at the same time in a single boiler furnace. It was difficult enough to regulate automatically the combustion of coal or oil, but when it became a matter of economic necessity for a plant to fire a boiler with two or more fuels in differing proportions, then combustion control took a long step forward. For instance, a steel plant wishing to use as much by-product gas as possible rather than waste it in the air would combine the gas with powdered coal, a highly volatile



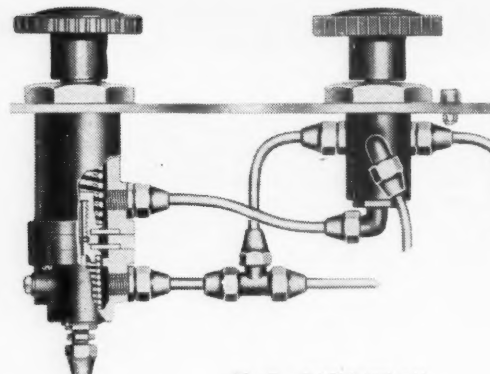


CONTROL BOARD

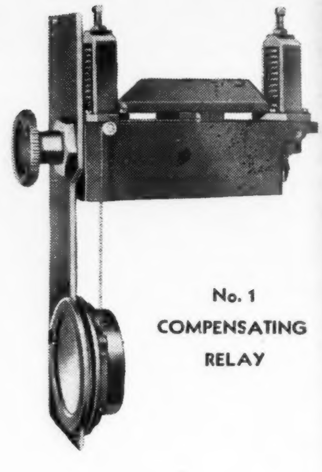
Front and rear views of the master panel in the new boiler plant of the West Penn Power Company's station at Springdale, Pa., near Pittsburgh. This is the "brain center" of the Hagan combustion-control system. The rear view shows the compressed-air piping. Each of the four sections of the board controls the operation of one boiler.



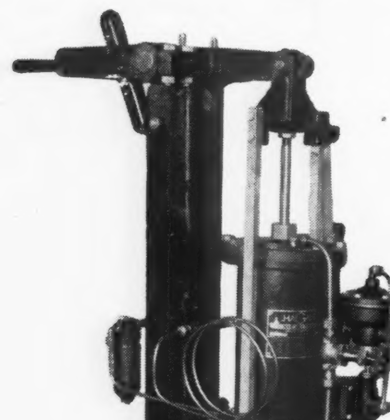
No. 3 - MASTER SENDER



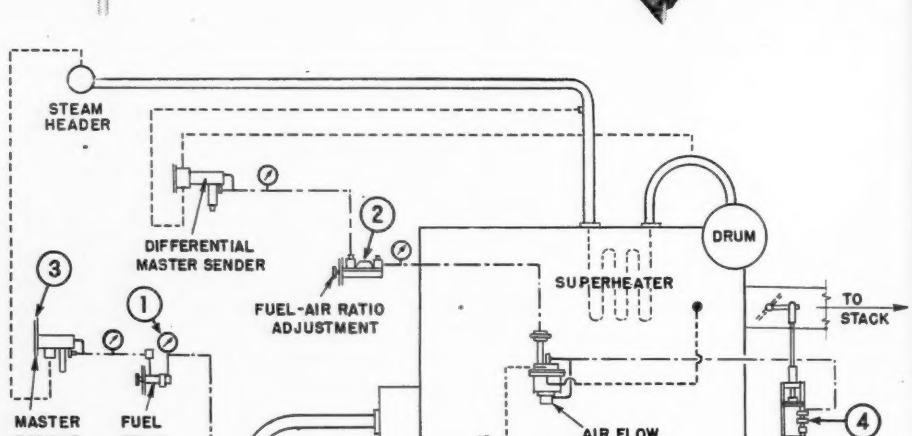
No. 2 - RATIO RELAY



No. 1 COMPENSATING RELAY



No. 4 - RECEIVING REGULATOR



SCHEMATIC DIAGRAM

Basic arrangement of a Hagan differential master control system as applied to a boiler fired with pulverized coal. It is designed to overcome variations in the size of the coal and its moisture content, which might normally cause an unwanted change in the air supply. Bordering the diagram are four essential pieces of equipment, keyed with numbers showing where they are used. The compensating relay permits the entire system to be placed under manual control for starting up and shutting down. The ratio relay makes it possible from the panel front to adjust the fuel-air ratio for most efficient combustion. The master sender converts steam pressure into air-loading pressures (0 to 60 pounds) that act as a signaling system calling for more or less fuel or combustion air. The receiving regulator is a pneumatic piston that operates dampers and fuel-feed controlling devices.

fuel that calls for safeguards. On occasions it would burn by-product gas alone. Then, as the supply dwindled, the powdered coal would be turned in. At other times oil might be used. Even sawdust has been burned in combination with other fuels. Regulation or control of the combustion of such fuels in varying amounts, always with perfect air-proportioning and with complete safety in case any device failed, was one of the toughest jobs tackled and whipped.

An engineer need not look too far back into the past to remember when a boiler plant consisted only of a feed pump, chimney, boiler, and a scoop shovel. There is probably no engineering problem that has received more intensive study than that of reducing the cost of steam. The result of all this research has been the development of many different types of equipment. Some have achieved temporary popularity, only to be displaced by others as the art progressed. The fact that automatic combustion control has steadily gained in popularity seems to prove that it has made a real contribution towards the economy of steam production. But it has done more than pave the way for economies. There are any number of industries—food plants, breweries, beverage plants—where the quality of steam matters greatly, where it should be clean, dry, and free from contamination.

When the Hagan Corporation entered the combustion control field a quarter century ago, boilers were very inefficient. Many were fired manually, and combustion was controlled manually. In consequence of the guesswork (the human element) involved, fuel was wasted and boilers failed by a wide margin to deliver the efficiency their makers had built into them. To save the back-breaking job of hand-firing, stokers came into being and skilled attendants replaced laborers as operators. But on this basis alone the stoker could not justify itself. It also had to save fuel. To do that, too much depended upon guesswork in controlling combustion.

As Mr. Peebles described the idea of automatic control some time ago: "Sleight of hand artists have proved that the hand is quicker than the eye, but no hand is as quick or as accurate as a machine when it comes to checking the combustion of fuel.

An engineer might watch his dials in vain for a chance to anticipate a drop in temperature or pressure in time to level the curve. The machines, which automatically react to such a drop before it is evident on the dial, set in motion counteracting forces which start combustion up a notch or two in time to avert a drop of any consequence. The result is that we have automatic control which flawlessly protects steam-power for any operation, without the touch of a human hand."

Automatic combustion control is commonly accepted by industry today. It is standard in the country's great utilities power plants and is growing rapidly in the marine field. More than 1200 ships already are so equipped, Hagan having engineered the first system for a tanker in 1936. The U-boat menace gave automatic combustion control a great opportunity to prove its value in warfare. It is well known that telltale wisps of smoke spiraling upward at sea gave the sub knowledge of the presence of a target miles beyond its normal range of vision. Automatic control eliminates the smoke. Many a tanker captain and cargo-vessel skipper, when in a tight submarine zone, gave prayerful thanks in 1942 and 1943 that his ship did not betray herself in that way.

An outstanding example of the effectiveness of the mechanism was that offered by the *Cape Neddick*, a merchantman that was torpedoed at sea in 1942 while Africa-bound in a convoy. A 20-foot hole blasted in her side in the dead of night caused her to make tons of water, heel over, and settle down 12 feet by the head. The captain gave the order to "abandon ship." As the skipper, officers, and crew prepared to leave in lifeboats, they noticed that, in the words of the captain, "The ship seemed to rest a bit in the water, shake herself free and give a great sigh. Then I realized that, due to her stout construction, only one compartment was punctured and flooded."

Four engine-room volunteers again went aboard and found that her power plant was still seaworthy—the automatic combustion control was still maintaining the same steam pressure as before the order to "abandon ship" was given. This enabled the craft to get underway immediately. Signaling to the boats that they would be picked up later, the vessel eluded a final torpedo attack and zigzagged away to safety. At daybreak the *Cape Neddick* returned for the remainder of the crew and proceeded 850 miles to Africa, where she unloaded her cargo of heavy tanks and locomotives. She was later repaired.

It is true that there are still some oldtimers in ship engine rooms who are skeptical about the merits of the system. But experience with real seagoing equipment, which is tough and rugged, soon changes their minds. They discover that it does a good job every minute under any conditions and that there is less temptation to "go on manual" as soon as they are out of port.

Hagan Corporation's beginning, as is true of many industries, was guided a great deal by chance. It was an outgrowth of the old George J. Hagan Company, still in existence, which built industrial furnaces. The corporation was the first ever to burn coke breeze in a chain-grate forced-draft stoker. That material (the first to come through the coke screens) was regarded as waste in those days, and plants obtaining it as a by-product dumped it to such an extent as to form gigantic mounds sometimes half a mile long and four or five stories high. Because of its small size and volatility the fuel was not considered of commercial value. Hagan proved that it could be burned under steam boilers, using a grate originally designed for anthracite coal. This stoker saved industries hundreds of thousands of tons of fuel.

The combustion-control idea sprang into being through a chance encounter in a restaurant of Mr. Hopwood, then with the Hagan Company, and Mr. Peebles, who at that time was an engineer in the stoker department of Westinghouse. As a result of their mutual interest in combustion problems, in the need of a system that would regulate all phases automatically, the two joined forces in 1917. An early challenge was the installation of some form of automatic control for the boilers of the Continental Works, Pittsburgh, of the National Tube Company. Mr. Peebles went to work on the design. When the rugged device was in place and operating, it was found that fuel efficiency had risen from 58 to 70 percent. Since nothing else had been changed, the officials decided that there must be something to this business of automatic control and asked Peebles to do the same thing for their other plants at Ellwood City and nearby towns. Fifteen years later, when the old Pittsburgh mill was torn down, the original system was transferred to the company's plant in New Castle, Pa., where it continued to give good service.

A feature of Mr. Peebles' designing is sturdy construction of equipment so that it will stand up under the hard, grueling job it is built to perform day in and out. In proof of this is cited the following amusing incident which happened in the mill of the Wheeling Steel Corporation, Wheeling, W. Va. During the early days of the depression the plant was shut down for four months, and when work was resumed with new boiler engineers on duty there seemed to be something uncanny about the way the units operated. "We can't figure it out," said one of the men. "No matter whether the demand for steam goes up or down, the boilers seem to adjust themselves without anyone doing a thing to them. It's like having a ghost alongside. What's the reason for it?" So Peebles went there and showed the boiler-room staff the combustion-control system, filthy with dirt but functioning as if it had never been shut down.

As an engineer, Mr. Peebles sees much to be desired in the way automatic combustion-control systems are purchased. "It is particularly important," he says, "that consideration be given to the design of the ductwork so that the air- or gas-flow measurements can be made accurately. Auxiliary equipment should be selected with a view to its adaptability to automatic-control operation. It is often necessary to devise a more cumbersome way to get the desired results just because combustion control was not part of the engineering plan in the first place. Greater simplicity and operating economy can be achieved more easily if all these things are considered in building new plants."

EARLY MASTER BOARD

The first Hagan combustion systems were primitive compared with those now available, but they did their work effectively, the regulators functioning despite grime and dirt.

Air Bubbles Save Ducks

SAFE RESTING PLACE FOR MIGRATING DUCKS

The lagoon in Juneau Park which is prevented from freezing over by agitating the water by means of bubbles rising from perforated pipes laid on the bottom. Air at from 3 to 4 pounds pressure is sent through the lines and is supplied by a small motor-driven compressor controlled by a thermostat. The system is operated from the beginning of December through March at an expenditure of about $30. The cost of the installation to the city was approximately $2500, exclusive of the engineering charges which were written off the books.

THOSE interested in the conservation of our national wildlife will be heartened by the following story which concerns the efforts of a large corporation to save the lives of ducks. The corporation is the Allis-Chalmers Manufacturing Company of Milwaukee, Wis., and the men that are immediately responsible for the rescue of many of these aquatic creatures are Herman Falk, director, and Charlie Martin, hydraulic engineer, working in coöperation with the Milwaukee County Park Commission.

Usually, and rightly, it is man who is blamed for the decimation of our wildlife, but this time Nature was the enemy—ice forming on Milwaukee's Juneau Park lagoon. Mr. Falk, in his almost daily visits to the park to feed and watch the ducks, noticed that many of those that settled on the pond for rest and food during their annual migrations southward were injured or perished when a sudden drop in temperature caused the water to freeze. The ice held them in its grip, and efforts to release them by chopping it up were of little avail.

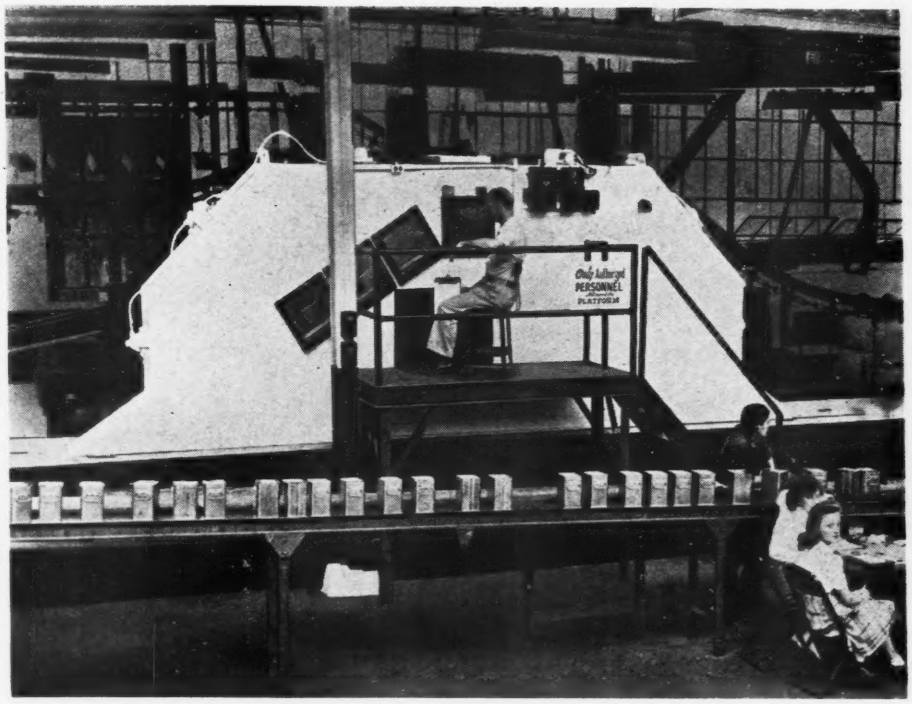
Concerned about the plight of the birds, different measures were tried to keep the pond open, but without success. It was then that Charlie Martin was called in and solved the problem by means of a compressed-air system invented by Philip Brasher and used, among other things, for preventing ice from forming around the gate structures of power dams. As designed by Mr. Martin, the installation consists of a series of seven pipes each 84 feet long and set 5 feet apart. The piping is perforated with numerous $\frac{1}{32}$-inch holes and rests on steel supports driven into the bottom of the lagoon. Air is supplied to the lines by a header connected to a "pill box" on shore housing a compressor that is driven by a 1-hp. motor and has a capacity of 15 cfm. The system is controlled automatically by two thermostats one of which functions as soon as the temperature drops to a point close to freezing. This unit starts the motor-compressor. The other goes into action at 10 degrees below zero and turns on a 1-kw. heater to prevent the formation of an ice cone at the orifice of the air-discharge pipe.

The so-called "bubble bath" was installed in 1944 and worked the first time it was put to the test late that year. The thermostat set to operate at 32° had the motor going without delay. Quicker than it takes to tell, the compressor was feeding air at from 3 to 4 pounds pressure into the pipes, and from 588 holes steady streams of bubbles rose to the surface, causing it to ripple. That day the mercury kept dropping; but even so, except for a rim of ice along the shore, the body of water remained open.

As explained by Mr. Martin: "The lagoon is prevented from freezing by more than just the principle of agitation. Hydraulic engineers have long known that water reaches its greatest density at 39°F. The warmer, denser water sinks to the bottom, but the ascending bubbles force it back to the surface. This, in turn, forces the lighter and colder water to the bottom, where it is warmed."

In consideration of all these factors, Mr. Martin is convinced that the pond will not freeze over even when the thermometer registers 25 degrees below zero, which is the lowest temperature recorded in Milwaukee in 62 years. Conservation and civic groups north of the Mason-Dixon line are much interested in what has been done there toward wildlife preservation, and it may not be long before hundreds and thousands of migrating ducks and other birds will, as it has been so aptly expressed, fly from one fizzing pond to another during their long migrations southward.

Vacuveyor Unit for Detecting Leaky Cans



THE VACUVEYOR IN SERVICE

Picture of the unit used by Chrysler Corporation at its Evansville, Ind., ordnance plant for testing metal ammunition containers. The cans entered the machine at the left end and traveled upward through a vacuum chamber where telltale bubbles revealed the leaky ones, thence moving downward and out at the right end. Three vacuum pumps are seen mounted on top of it. The one at the right was automatically controlled by a float valve that maintained the water in the test chamber at constant level and caused the unit to run for a matter of seconds at intervals of approximately 25 minutes. The two other pumps were manually controlled and served to lift the water once a week when the machine was refilled after cleaning.

A VACUUM-TESTING machine for continuously detecting leaks in hermetically sealed metal containers was designed and built during the war for use in the Evansville, Ind., ordnance plant of the Chrysler Corporation. It was so successful in testing cans in which the firm packed .45- and .50-caliber carbine cartridges for overseas shipment that other concerns engaged in similar war work were requested to adopt it by the Office of Chief of Ordnance, Small Arms Division, Ammunition Branch. Altogether about twenty of the units were manufactured and placed in service.

Prior to the development of the apparatus the Evansville plant had been spot-checking four cans out of every lot of 50 by placing them in a metal-topped bell jar containing water and held under a vacuum that was induced by a small vacuum pump and recorded on a mercury U-tube. This caused bubbles to issue from any imperfect can; but as only a small percentage of the containers was tested, some that leaked were approved by the inspectors. In conjunction with this spot check the cans were passed through a tank of water which was heated by means of steam coils, but this operation was discarded because it failed to produce sufficient pressure inside the containers to provide a positive check. Other methods were tried and abandoned before a decision was reached to develop a continuous system that would give conclusive results.

The problem was turned over to a member of the plant engineering staff, R. H. Dickman, who designed the unit afterward used and to which he gave the name Vacuveyor. It was constructed of heavy-gauge steel plates and is 45 feet long, 5 feet wide, and approximately 13 feet high. It had a normal capacity of 780 ammunition cans an hour, but this could be raised to 1200 by making minor alterations. The cans were carried into the Vacuveyor by an electrically operated conveyor which first entered a water tank and then moved upward into a test chamber which also contained water and was evacuated by means of vacuum pumps mounted on top of the machine. When a leaky container reached the test chamber, bubbles escaped from it rapidly because of the pressure differential between its interior and exterior. Heavy plastic windows on one side of the unit that were capable of withstanding the pressure to which they were subjected by reason of the evacuated area permitted an attendant to observe the cans as they passed through the machine. The conveyor flights were all numbered, thus making it possible to identify a defective container for subsequent removal. The operator noted the flight number on a small metal tag. This he placed on a declining wire, down which it slid to a position beside an attendant at the discharge end of the Vacuveyor. There it contacted a microswitch that energized a red light and rang a buzzer to attract the attention of the attendant, who removed the designated can when it emerged from the unit.

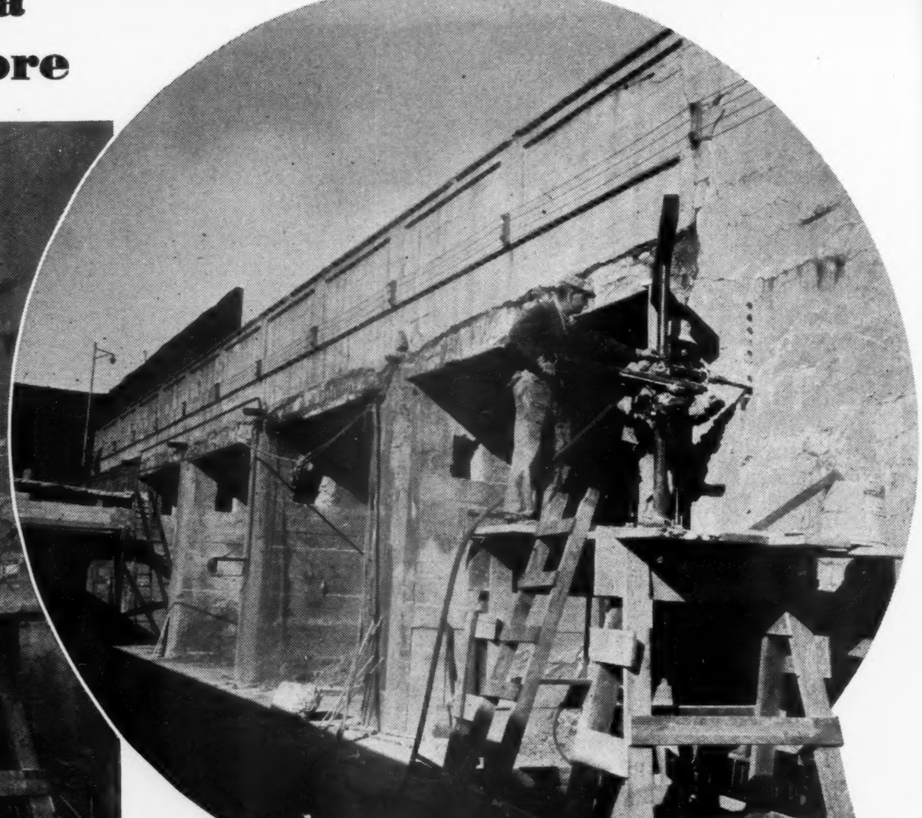
The machine is of relatively simple design with few moving parts. A float control valve maintains the water in the lower tank at a predetermined level and the liquid in the entire system at a constant volume. An automatic vacuum float control disconnects the vacuum pumps when the proper head of water and the desired vacuum are reached in the upper chamber. A small gearhead motor keeps the conveyor in motion, and an overload type of clutch acts as a safety device. Water in the lower tank is automatically sealed from the test chamber at the points where the cans enter and leave the top section of the machine.

Mr. Dickman has devised two accessory pieces of equipment that can be applied to the Vacuveyor for marking leaky containers. One is an air cylinder that is mounted on top of the test chamber. When this unit is actuated by a hand-operated air valve on the outside of the machine a piston is extended and, by means of an arm with a stamp, marks each defective can so that it can be identified later and removed from the line. The other method involves the use of a photoelectric-cell circuit which picks up the action of the bubbles, interrupts a beam of light, and automatically sets in motion a solenoid pusher arm that shoves the faulty can onto a second conveyor devoted exclusively to the handling of rejects.

The Vacuveyor at the Evansville plant handled hundreds of thousands of metal cartridge containers the purpose of which was to protect the ammunition from corrosion and other possible damage. The hermetically sealed cans replaced waxed cardboard boxes which were packed in wooden shipping chests and which did not provide ample protection. The metal containers were opened by the soldiers by twisting keys similar to those that come with sardine cans. The Vacuveyor is expected to have a wide field of peacetime service. Suggested uses are the testing of cans for packaging foods, radiator cores, floats, gas tanks, refrigerator condensers, and other articles.

Rock Drill Does a Construction Chore

2



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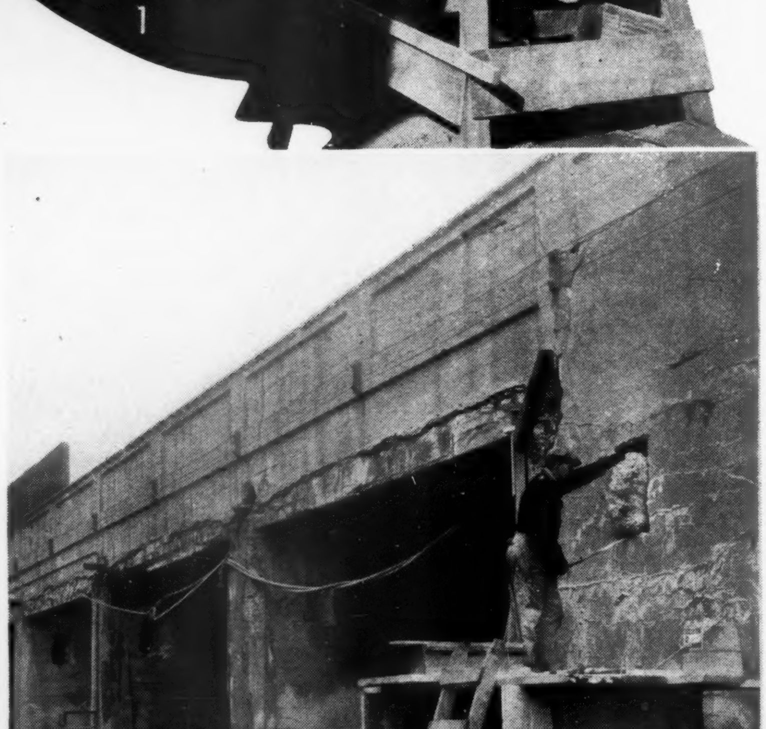

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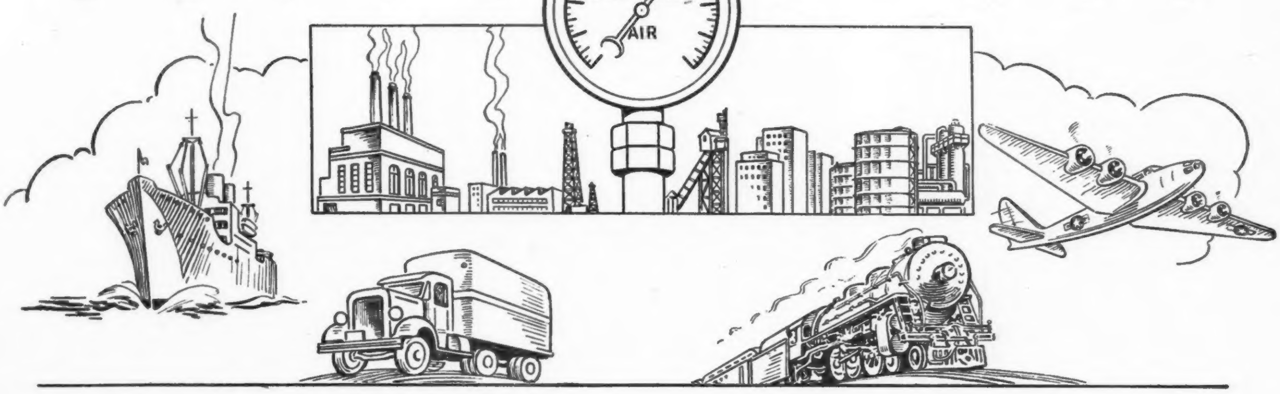
THESE pictures show how a standard rock drill was used to cut holes in concrete walls in connection with construction operations at a New Jersey foundry. Various grades of sand and other materials are received in railroad cars that are run in on a concrete viaduct and dump into bins underneath. The foundry supply is drawn from the bins, as needed, by industrial trucks and tractors. Because of trouble in winter from snow and ice, freezing of the materials, etc., it was decided to roof over the areaway between the foundry and the bins. This necessitated placing some steel beams which were to be partially or wholly supported by the viaduct bin structure. The job was to cut the required holes in the concrete walls as quickly and inexpensively as possible.

Most of the openings were made in the transverse bin-division walls and extended clear through their 36-inch thickness. Others were made in the longitudinal supporting wall and penetrated only far enough to provide a firm bearing for the beams. These views illustrate the procedure followed for the latter type, although the set-up was the same for all.

A 55-pound Jackhamer was mounted on a column and arm, the column being held rigid between the working platform and an overhead horizontal timber member extending from the wall and supported by a timber upright. Holes spaced two or three inches apart were then drilled to a depth of 12 inches to form a rectangle outlining the section to be removed. No. 1 shows the driller completing the last hole in a row forming one side of the rectangle. A broaching tool, with a rounded shank that would not be turned by the drill's rotating mechanism, was next used to break out the concrete between adjacent holes.

This formed a slot around the block, but the latter was still attached at the back and had to be broken loose. This was accomplished by prying with a chisel driven in by hand (No. 2). The final step, illustrated in No. 3, was working the block out with a thin bar. In the case of the transverse walls, where the holes were cut clear through, the blocks were simply pushed out. Some of the openings thus made can be seen in all the pictures, and at the base of one of the walls is one of the blocks that was removed.

EDITORIALS



SLATE RESEARCH

ANY industry that now employs only 10 percent as many persons as it did twenty years ago obviously needs some sort of a "shot in the arm." The slate producers of eastern Pennsylvania find themselves in that situation, and they are taking a "research hypodermic." Theirs is an industry with more than 100 years of background, but it has not been entirely a century of progress. The curve moved steadily upward until 1928—the year of peak output—and then started to decline.

Slate is a superior material for many purposes, but it is heavy and it is breakable to a degree that requires it to be protected for shipment. Transportation costs beyond truck-delivery zones are consequently high. Inevitably, then, many former users have turned to substitutes to save money. Slate has lost a lot of roofing business on that account.

Those of us who were born around the turn of the century or earlier harbor memories of the red-cloth-fringed school slates that contributed importantly to our primary education. First there were single slabs, and later a *de luxe* double model joined along one edge so that it could be opened like a book and afford four writing surfaces. These once essential aids to instruction that were sold by the millions have given way in this country to paper tablets and notebooks, although they are still used in some foreign nations. No suitable substitute has thus far been found for the larger "blackboards," and they remain one of the principal products of the slate industry. Other important ones are billard-table tops and burial vaults.

All in all, however, the business has been losing its former robust health; hence the decision to call in the scientific doctors. The slate men of Pennsylvania have themselves diagnosed their ailment. There are aggravating complications, but the chief trouble is that of every 100 pounds of slate quarried only 15 pounds gets to the market. The other 85 goes on the waste dumps. Quarrying costs are mounting, skilled workers are getting scarcer. Therefore the determination to see if the vast accumulations of waste rock can be beneficially employed. Some of the lines of investigation that are being followed are outlined in the first article in this issue. It is to be hoped that these measures will be successful in restoring economic virility to one of our most venerable mineral industries.

CASH FOR PHOTOS

TO MEET the need for outstanding photographs for reproduction on our cover we offer prizes of $50, $40, and $30, respectively, for the three best pictures that reach us by May 1, 1946. For other suitable ones that fail to win one of these prizes we will pay $10 each.

Photographs may pertain to any of the activities in the fields we cover. They should preferably be related to some use of compressed air, but we do not want close-ups of compressors, rock drills, pneumatic tools, etc., unless there is some special point of interest in connection with them. Pictures should have human appeal in addition to photographic merit.

Our cover picture occupies a space roughly 7x7 inches, which means that the area of interest must be approximately square; that is, we must be able to crop it to fit our space without eliminating anything worth while or of pictorial value. Where either the length or height of a photo submitted is less than 7 inches, the negative should be sent to enable us to make a print large enough for our use. Such negatives will be returned upon request.

Each picture should be accompanied by 100 words or more of explanatory text. Payments for all photos accepted will be made by June 1, 1946. Address: Editor, Compressed Air Magazine, Phillipsburg, N. J.

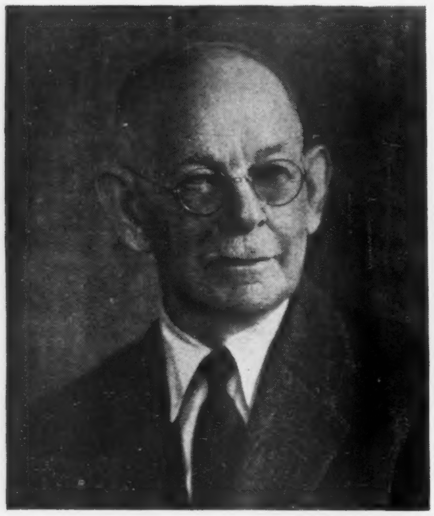
IS THE WAR OVER?

AT THE completion of a Broadway show the curtain comes down and everybody goes home. The show is over so far as that particular audience is concerned. It would be nice if we could wind up a war that easily, but it just can't be done. In a manner of speaking, we have been at peace for more than half a year. The guns are silent, but we still have millions of men in uniform, and there are a thousand and one things to be done before we can return to normal living.

During hostilities the American people responded splendidly to the appeal to buy War Bonds. All told, 85,000,000 of us bought them. The biggest purchasers of E Bonds were the 27,000,000 persons who regularly invested 10 percent of their wages or salaries in these securities through payroll deductions. There is a tendency now to let down. The average earner feels, and justly so, that he did a lot while we were under arms and he is in the mood to relax a bit, to have a little more fun, and to buy such luxury articles as he can find for sale. Nevertheless, the juggernaut of war economy is still rolling along under its own tremendous momentum, and it can be stopped only by a gradual slowing-down process. The brakes are being applied, but there is a considerable period of deceleration ahead of us. It costs money to demobilize the huge military and civilian wartime organization.

War Bond drives are over. You can't even buy a War Bond now, but you can still get a Savings Bond, which is the identical security under a pleasanter name. Savings Bonds are a prime investment and a potent weapon for combating inflation. Six billion dollars worth of these "shares in America" are to be sold by the Treasury Department during 1946. The largest group best able to buy is made up of the people on payrolls. Most employers are retaining the deduction plan to enable workers to continue the commendable habit of systematic saving that they acquired during the war years. For those not on payrolls, the regular sources—banks and postoffices—are available.

"Moles" to Honor Two Construction Leaders



OSCAR W. SWENSON

MILES I. KILLMER

THE annual awards of The Moles, New York organization of tunnel and heavy construction men, for "outstanding contributions to construction progress" will this year go to Oscar W. Swenson, pioneer railroad builder, and Miles I. Killmer, veteran tunnel driver. Mr. Swenson will receive the nonmember award and Mr. Killmer the member award. Presentations will be made by Arthur A. Johnson, president of The Moles, at a dinner meeting in New York on February 6.

Mr. Swenson, now in his 82nd year, is president of Foley Bros., Inc., of New York, which has constructed some 26,000 miles of railroad. His career spans the period during which railroad building has progressed from the use of hand labor and horses to highly mechanized equipment. During his younger days in the Northwest he saw both General Custer and Sitting Bull, and he often made exploration and inspection trips on snowshoes involving hikes of up to 600 miles.

Upon finishing grade school, Mr. Swenson worked with a railroad survey party in Minnesota and later attended Carlton College at Northfield, Minn. In 1885 he joined the organization of the four Foley Brothers, who had come to this country from Canada and started a contracting company. After spending some time as a supervisor of logging and sawmilling operations he transferred to the construction field and held successive posts in the firm until he became its head. During that period he built railroads in all parts of the United States and Canada, dams in California, tunnels in the East and West, railroad terminals and harbors in Nova Scotia, piers and docks in New York Harbor, dry docks in Philadelphia and Norfolk, airports in Nassau, roads and docks in Persia, and numerous buildings and bridges in other localities. He was also identified for short periods with mining operations in Montana and India.

Despite his advanced age, Mr. Swenson is very active physically. On his 72nd birthday he played 72 holes of golf and even carried his own bag during the last nine, when his caddy gave up. He is still an ardent golfer. In the course of his career he made friends of many men who were prominent in the upbuilding of the western United States and Canada. These included James J. Hill, president of the Great Northern Railway; Sir Henry Thornton, president of the Canadian Northern Railroad; Lord Shaughnessy, president of the Canadian Pacific Railway; and Sir Harry Oakes, who developed the Lake Shore gold mine in Canada.

Mr. Killmer is vice-president and general manager of Mason & Hanger Company, New York contractors whose history goes back well over 100 years. Except for short periods when he was engaged in dam building and rock tunneling, and an interval of seventeen months spent as captain in the Army Engineers during World War I, he has devoted his professional activities to compressed-air tunneling, a field in which he is recognized as a specialist.

Born in Pennsylvania, Mr. Killmer's first work was that of teaching in a country school for a year. Then he studied engineering at Pennsylvania State College. During summer vacations he played professional baseball in the minor leagues. Following his graduation in 1906 he took a $60-a-month job as chainman in the East River tunnels being built by the Pennsylvania Railroad and was promoted several times until he became an inspector. He next became a tunnel foreman on the Lexington Avenue subway project in New York. In 1914 he became assistant engineer of the New York Public Service Commission and worked on various rapid-transit tunnels under Division Engineer Clifford M. Holland, who later directed the construction of the vehicular tunnel under the Hudson River that bears his name.

After his army service, Mr. Killmer resumed work under Mr. Holland, who had meanwhile been appointed chief engineer of the joint New York and New Jersey Tunnel Commissions. He became construction engineer on the twin 32-foot-diameter Holland tubes and spent most of his time until the job was finished in 1926 "down in the hole" under air pressure that ranged as high as 48 pounds per square inch. Mr. Killmer joined the Mason & Hanger organization in 1928. Since then he has directed for that concern the construction of two East River subway tubes, the twin tubes of the Lincoln vehicular tunnel from New York to New Jersey, the Rays Hill Tunnel on the Pennsylvania Turnpike, and the Merriman Dam at Lackawack, N. Y., one of the structures of the Delaware River Aqueduct built by New York City. Work on the dam was halted in 1943 by wartime shortages of materials. At present he is in charge of operations at the New York end of the New York-Brooklyn vehicular tunnel, on which work has been resumed following suspension during the war.

Parts Cleaning Machine

WHAT appears to be a useful piece of equipment for machine shops and repair and service stations generally has been developed by the Park Chemical Company. It is a cleaning tank 36 inches high, 35 inches long, and 17 inches wide which is filled to a depth of 18 inches with a special solution called Tank-Solv. It is designed to handle large parts individually and small parts such as screws and washers in bulk. The latter are placed in a round basket that is immersed in the bath and swished about by hand or rotated mechanically. After a short period of soaking, the container is placed on an attached shelf from which the fluid drains back into the tank. Articles are then rinsed with water or petroleum spirits and blown dry by means of an air gun.

Castings, machined parts, tools, and other large objects are similarly treated but are placed directly into the solution, which is agitated with compressed air rising from a series of holes in a pipe running the length of the tank. One cubic foot of air per minute is required for the 20 to 25 gallons of Tank-Solv used. The latter is not heated and is of the kind that does not evaporate. Another advantage claimed for it is that it cleans by physical action and thus allows all grease and dirt to settle immediately. Machine is ready to operate as soon as it is attached to an air line.

Insulation of Molded Pulp

THROUGH the development of a fiber-molding process, the Pittsfield Works of the General Electric Company has dispensed with the slow taping method by which windings or irregular-shaped instrument-transformer parts are generally insulated. The raw material consists of sheets of specially prepared kraft paper, asbestos, rags, rope, etc., which are soaked in water and converted into pulp in a motor-driven beater lined with rubber to prevent corrosion or impairment of the insulation.

After defibering, the slurry is pumped into a stock chest where the solids are kept in suspension by air agitation. The object to be insulated is immersed in the fluid, but before that is done it is wrapped with tape through which is inserted a fiber tube the free end of which is attached to a suction hose. When a vacuum is pulled on the line the pulp is drawn against the part, the process continuing until the wall is of the desired thickness. Distribution is said to be fairly uniform and the weave of the tape is such that excess water passes through it for disposal.

When the work is removed from the stock chest, suction is again applied to it to partially dry the molded pulp. In some cases the tube is left in place, and irregularities are smoothed out, if necessary, by hand or mechanical means. Before the part is ready for checking against blueprints and assembly, it is again wound with white tape, this time to protect it against impurities while undergoing thorough drying in ovens.

Research Pays Dividend

THE two-billion-dollar gamble of the atomic-bomb program had to draw to many an inside straight in its race against time and the enemy. That it was successful in at least one of these long chances can be laid to the curiosity of a research scientist working in the comparative obscurity of a small laboratory at the Westinghouse Lamp Division in Bloomfield, N. J. The link that drew the two together was the urgent need for pure uranium. All other elements in the atomic project were available: money, manpower, laboratory facilities, and a backlog of research. Lacking only was a ready supply of pure uranium, or the time to produce it. It would have taken months for the plants then being erected to turn it out; and each day's delay meant postponement of the bomb's achievement and prolongation of the war.

URANIUM SOURCE

All the pure uranium that was available to scientists at the outset of the atomic-bomb project was made by this laboratory set-up at the Westinghouse Lamp Division in Bloomfield, N. J. Research Engineer W. C. Lilliendahl is shown placing a small cube of pressed uranium into a crucible at the bottom of a coil preparatory to heating it by induction in the big bottle at the right.

This is where the curiosity of Dr. Harvey Rentschler paid off, for the scientist, now Director of the Lamp Research Laboratories, had been producing pure uranium in small lots for many years before atom-splitting became a national program. In fact, the few tiny lumps of pure uranium available in America when the atomic project was started came from Doctor Rentschler's little laboratory. The Westinghouse scientist first hit the uranium trail after the close of World War 1 when searching for a material superior to tungsten for lamp filaments. That the metal didn't work in this application was no deterrent to Doctor Rentschler. Using a crude but effective laboratory set-up developed by him in coöperation with Dr. John W. Marden, Assistant Director of the Laboratories, he continued to make pure uranium a few ounces at a time for further study and to supply the demands of scientific institutions.

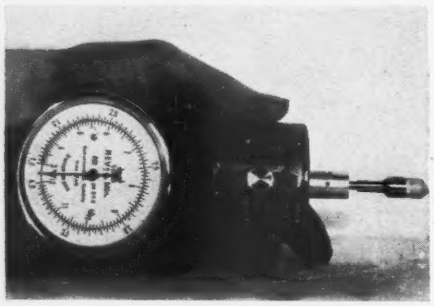
Then came the all-out atomic-bomb program and the great need for uranium. By the end of 1942 production had been boosted to 100 pounds daily and Westinghouse still was the only source of the metal. In the first experimental atomic-power generator, constructed at the University of Chicago and put into operation on December 2, 1942, the uranium made by the Rentschler-Marden process played the dominant role, and of several thousand pounds of the precious metal used in the "pile" all but a few hundred pounds came from Westinghouse. It was probably one of the largest dividends ever paid on scientific curiosity, which marks the daily efforts of all men of research.

FIGHTING AN UNDERGROUND MINE FIRE

Members of the Hecla Mine fire-fighting crew are shown above combating a blaze in the nearby Sunshine Mine in the Wallace, Idaho, area. They are wearing the Scott Air-Pak, a new type of breathing apparatus. The cylinders contain compressed air, which is fed to the respirator masks. The fire in the Sunshine Mine, largest silver producer in the United States, broke out in a battery-charging room on the 2700-foot level and quickly spread through the timbering to both the 2500 and 3100 levels. Trained fire-fighting crews from the Hecla, Bunker Hill, and other mines in the district hurried to the aid of the Sunshine crew, and the U. S. Bureau of Mines sent rescue cars from Salt Lake City and Butte. Because the men had been prepared for such an emergency and had modern equipment the fire was extinguished without casualties. All production from the Sunshine Mine had to be suspended for several weeks while the flames were being brought under control and the workings cleared of smoke and gases.

Industrial Notes

George Scherr Company has announced a line of new hand tachometers which, it is claimed, enable engineers to read accurately the revolutions per minute of any revolving equipment. The instruments operate on the centrifugal principle and have five speed ranges from 30-12,000 rpm. for Model A to 120-48,000 rpm. for Model D, thus making it possible to measure the speeds of generators, combustion engines, transmission pulleys, pumps, lathes, etc. Shaft revolutions as close as 1 rpm. can be determined. The dial of each tachometer is calibrated individually, quick change of speed is effected with a knurled ring, and an attachment is provided to give feet per minute.



Lonn Manufacturing Company is offering a pneumatic spray gun that is designed for the removal of dirt, oil, and grease from machinery with kerosene or other cleaning fluids. The amount applied is controlled by slight pressure at the nozzle end, and release of pressure shuts off the supply. With the fluid hose detached, the gun can also be used as a compressed-air blower or drier. It is obtainable with either a straight or a curved stem for cleaning engine parts or motors, respectively.

Oversize plywood sheets for concrete forms are produced by the Washington Veneer Company, Olympia, Wash., for distribution through dealers. They are made of standard panels with beveled ends cut to taper gradually, are bonded with waterproof adhesives, and sanded to a smooth finish. Sheets varying from 14 to 50 feet in length, 4 feet in width, and ¼ to ¾ inch in thickness are available. Panels of the latter size and ¾ inch thick have an area of 2500 square feet and weigh about 550 pounds.

Because Briggs & Stratton Corporation, manufacturer of automotive parts and gasoline engines, was having trouble with leaky air valves in its machine shops, engineers of the concern designed a valve to overcome the difficulties. Their investigations convinced them that leakage and failure of air valves are caused principally by (1) lack of a permanently clean seal between the valve and valve seat; (2) corrosion of valve ports; and (3) wear of valve parts. In an effort to prevent these things, they built their new valve and valve seat of wear-and-corrosion resistant stainless steel and used a copper gasket to provide a leakproof "set" for the valve.

The valve gave such good service in its own shops that the company began making it for the trade under the name "Air-Saver" air valve. It is marketed by Palmer-Shile Company of Detroit, Mich., and is applicable to machine tools, diecasting machines, and also wherever metal parts have to be dried after being washed. The accompanying illustration shows one of the units mounted on a drill press. It controls the admission of compressed air to a section of ½-inch tubing that directs it where needed for blowing away heavy chips as they are formed.

BOON TO NORTHERN HOUSEWIVES

This 3000-hp. diesel-electric locomotive, the most powerful one ever assembled as one unit, was placed in service in December hauling freight cars full of fresh fruits and vegetables from Florida to northern markets. Built by the Baldwin Locomotive Works for the Seaboard Air Line Railway, it is capable of running 120 miles per hour, but it will be restricted to a top speed of 85 miles. It is powered by two 8-cylinder engines which normally develop 1000 hp. each but to which 500 hp. has been added by using turbo-superchargers. The engines drive generators that furnish electric energy for eight traction motors. When fully supplied with fuel oil, lubricating oil, and engine-cooling water, the locomotive weighs more than 288 tons.

Laundry-type ironers that are used in the leather industry to finish the hides are being replaced by machines especially designed for that work. The main features are two motor-driven rolls and a pneumatic cylinder operated by foot control. One roll serves as a feeder and the other is electrically heated. The finisher comes in two standard sizes: an 80-inch length for handling goat, sheep, and other small skins and a 104-inch unit for treating sides and larger hides. These exert pressures of 3200 and 12,000 pounds, respectively, using air at 100 and 125 pounds pressure.

Long cane fibers, saturated with a special asphaltic compound, are the basic material of an expansion joint that is said to meet various Federal and other requirements. Flexcell, as it is designated, is made by the Celotex Corporation and is treated by the Ferox process to protect it from dry rot and termites. According

to the manufacturer, it provides a tight joint that adheres firmly to the concrete and expands when compression is released. It is light in weight, easily cut by hand or power saw, and is supplied by the linear foot in thicknesses ranging from 1/4 to 1 inch and in widths from 2 inches to a foot in 1/2-inch gradations.

Eatonite, a product of the Eaton Manufacturing Company, is a new alloy composed of nickel, chromium, cobalt, and tungsten. It is intended for facing valves of internal-combustion engines and is applied by welding, a groove being cut into the valve head for that purpose. Temperatures of 1000 to 1500°F. are said to have little effect on the hardness of the metal.

For the protection of blowgun operators against flying particles and chips, W. I. Martin & Company has designed a safety shield made of heavy-gauge transparent plastic. It fits any standard gun and is placed at the nozzle end by removing the tip, inserting it through the shield, and screwing it back on. Special attachments are provided for blowguns without detachable noses. The fixture also serves as a bumper for the tool when not in use.

Optimus Detergents Company has announced a new compound known as Deoxidant No. 3 for the removal of flux and welding and brazing scale. Although acidic in character, it is not a substitute for pickling acids but serves as a mild deoxidant for most metals. It is said to dispose of oxides and most scales with little or no smut formation in from 5 to 15 minutes. Deoxidization is followed by a quick hot-water rinse.

By combining the Stewart Cable Tester with the Cable and Pipe Locator, W. C. Dillon Company, Inc., has provided an instrument that is said to give both precise position and depth of buried pipe. The apparatus has many applications in the industrial and public-utility fields, among them the spotting of shorts, crosses, grounds, and wet spots and the checking, for example, of service lines when lowering or grading streets to determine whether they will be below the frost line. The apparatus is portable.

Hot, plastic paint and a new type of hose are making it possible, it is claimed, to give ships' hulls a skin that will minimize barnacle growth. The composition of the coating material, a wartime product, has not been divulged by the Navy, but the hose is made of synthetic rubber reinforced by two inner braids of Neoprene-coated Fiberglas yarn. It has an inside diameter of 1/2 inch, a minimum bursting pressure of 2000 pounds per square inch, and is resistant to a maximum temperature of 400°F., according to the DeVilbiss Company. The paint is applied with air at 100 pounds pressure.

Industrial Literature

Under the title *Abart Gears,* the Abart Gear & Machine Company, 4832 West 16th Street, Chicago 50, Ill., has issued a new folder on gears and speed reducers. It is listed as Form 297. All of this firm's gears are cut to customers' specifications and no stocks are carried.

Varied uses for traction-type dynamometers are described and illustrated in a booklet published by W. C. Dillon & Co., Inc., 5410 West Harrison Street, Chicago 44, Ill. It is claimed to be the first publication of its type ever issued. It is called the *Dillon Dynamometer Manual.*

Problems incidental to the collection of fine industrial dusts are described in Bulletin 101, issued by Aerotec Company of White Plains, N. Y. It describes the Aerotec tube, which is claimed to precipitate dust that could previously be segregated only by electrical precipitators. It is, however, complementary rather than competitive to such equipment. Copies of the bulletin are obtainable from the Thermix Engineering Company, First National Bank Building, Greenwich, Conn., project and sales engineers for Aerotec.

Extensive information on constant-voltage transformers is available in a new bulletin, *Electrical Power, Disciplined,* Form CV-102, offered by Sola Electric Company, 2525 Clybourn Avenue, Chicago 14, Ill. In addition to listing 31 standard Sola transformers in capacities from 15 va. to 10,000 va., the 36-page publication describes their construction, discusses operating theory, and includes a section devoted to new developments resulting from wartime experience.

A question-and-answer booklet has been issued to explain the Evans Thermo-Control fan for cooling internal-combustion engines. In construction, the fan is similar to a variable-pitch airplane propeller. The pitch is controlled by the temperature of the engine coolant, and the volume of air delivered consequently changes continually according to the engine's requirements. Resultant savings claimed include greater engine output, a reduction in engine failures, savings in the cost of fuel and lubricating oil, and virtual elimination of sludge deposits. Copies of the booklet are available from Evans Products Company, Fullerton and Greenfields Streets, Detroit 27, Mich.

Two new bulletins describing different types of Vortox air cleaners for use with internal-combustion engines or air compressors have been issued by the Vortox Company, which has been building this type of equipment since 1918. In these cleaners the air is subjected successively to three actions: centrifugal, scrubbing with an oil spray, and passage through an oil-washed filter element. Bulletin F-1295 covers Types G and GA, which have large capacities. Bulletin F-1297 deals with smaller units. Both are obtainable from the company's offices in Detroit, Mich., Claremont, Calif., and Dallas, Tex

Glossary of Cuban Woods, is the title under *which El Foro del Traductor* (The Translator's Forum) of Santa Maria del Rosario, Cuba, has published a booklet that describes all the better-known Cuban woods, gives their commercial applications, and lists information of value to those considering using them. The booklet was compiled by J. de D. Tejada and was issued to meet the needs of importers of wood for facts about the different species that grow there, the locations where they may be obtained, and the amounts available. A list of references is given for those who desire additional information. The glossary may be obtained from the publisher for twelve cents a copy.

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